



Environmental Existing Conditions

**Everglades Agricultural Area Storage Reservoirs Project,
Phase I**

Environmental Existing Conditions

**US Fish and Wildlife Service
South Florida Ecological Services Field Office
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3.5.1 Introduction

The Everglades Agricultural Area (EAA) Environmental Existing Conditions Report is a planning level document provided in support of the EAA Storage Reservoirs Project, Phase 1 (EAA Project). This report describes the environmental existing conditions present in the EAA. Specifically, upland and wetland vegetation types existing in the EAA and in Parcels A, B, and C (also known as the Talisman and Woerner properties) are described, along with EAA ecological communities as they pertain to fish and wildlife and threatened and endangered species.

In April 2003, a South Florida Water Management District (SFWMD) preliminary report identified environmental conditions in the EAA based on available data (SFWMD 2003a).

This report, prepared by the U.S. Fish and Wildlife Service (FWS), includes the preliminary report, summarizes additional researched information, and provides the results of a multi-agency wetland habitat verification and evaluation effort conducted in the EAA during the latter part of Fiscal Year 2003. The organization of this document loosely follows that of an Environmental Existing Conditions portion (Section 3.5) of a Project Implementation Report (PIR).

3.5.1.1 Project Description

The EAA Project Phase 1 and Phase 2 are components of the U.S. Army Corps of Engineers (USACE) Central and South Florida Project Comprehensive Review Study, Final Integrated Feasibility Report and Programmatic Environmental Impact Statement, otherwise known as the “Restudy” (USACE 1999). The EAA Project originally envisioned in the Restudy consisted of constructing three 20,000 acre above-ground reservoirs (60,000 acres total) with increased conveyance in associated canals. Two of the reservoirs would be constructed during Phase 1 and the third reservoir during Phase 2. The first reservoir would receive water from the EAA and be used to meet irrigation

demands only. The second reservoir would receive water from Lake Okeechobee releases to meet environmental water demands as a priority. In Phase 2, the third reservoir would receive water from Phase 1 overflows and Lake Okeechobee releases to meet environmental demands as a priority. However, exact configuration of the components will be determined through more detailed planning and design.

3.5.1.2 Study Area

The EAA is situated to the south of Lake Okeechobee within portions of Palm Beach, Martin, Hendry, and Glades Counties. Bordering the EAA to the south and east are Water Conservation Area 1 (WCA-1), otherwise known as the Arthur R. Marshall Loxahatchee National Wildlife Refuge, WCA-2, and WCA-3. The EAA encompasses an area of approximately 700,000 acres (SFWMD 2003b). Included in the EAA are the Rotenberger and Holey Land Wildlife Management Areas (WMAs) (approximately 25,000 and 35,500 acres, respectively) and six Stormwater Treatment Areas (STAs) (totaling approximately 36,400 acres). Parcels A (approximately 31,495 acres), B (approximately 9,522 acres), and C (approximately 8,884 acres) are the lands currently available to the EAA Project (totaling approximately 49,901 acres) and are located in the southern portion of the EAA in areas adjacent to the STAs and/or WMAs (USACE 2002). Figure 1 in Attachment A depicts the approximate boundaries of the EAA and Parcels A, B, and C.

Land in the EAA is primarily under agricultural production of sugarcane, vegetables, rice, sod, and improved pasture (Lodge 1996). Agriculture within the EAA requires fertilization and extensive drainage of approximately 500,000 acres of organic soils. Past drainage of the EAA and subsequent agricultural practices have led to excessive oxidation of the peat in the sawgrass plain and swamp forest located south of Lake Okeechobee. This drainage and oxidation has resulted in 3 to 10 feet of land subsidence in the EAA (USGS 2002).

Canals are utilized to maintain the water table and provide agricultural irrigation. Drainage water within the EAA, containing dissolved nutrients and particulates derived from erosional sediment and decomposed aquatic macrophytes, is routed from interior agricultural canals, through SFWMD canals, and subsequently discharged into the Everglades Protection Area or to tide. The EAA drains through six main canals operated by the SFWMD that connect to secondary canals and pump structures operated by individual landowners. The canals include the Bolles, Cross, Hillsboro, Miami, North New River, and West Palm Beach Canals (SFWMD 2003b).

3.5.2 Soils

A soil map of the EAA was generated using the U.S. Department of Agriculture (USDA), Natural Resources Conservation Service's (NRCS) soil survey database (FGDL 2000), distributed from the Florida Geographic Data Library (FGDL) (Figure 2) (SFWMD 2003a). The map was analyzed to determine the soil map units present in the EAA and Parcels A, B, and C. The percentage of each soil map unit for the EAA is presented in Table 1 in Attachment B. The percentage of each soil map unit for Parcels A, B, and C is presented in Table 2.

Based on the soil data (FGDL 2000), Terra Ceia muck, Pahokee muck, Lauderhill muck, and Torrey muck comprise 88% of the soils in the EAA. An additional 44 soil types together comprise the remaining 12%.

Within Parcels A, B, and C, Pahokee muck and Lauderhill muck comprise 84% of the soils. An additional 19 soil types together comprise the remaining 16%.

3.5.3 Ecological Communities

The SFWMD preliminary report identified environmental conditions in the EAA based on available data (SFWMD 2003a). The report included descriptions of ecological

communities in the EAA, descriptions of ecological communities in Parcels A, B, and C, and vegetation and wildlife lists obtained from several sources. The results from the previous report are discussed in this section. However, on-site wetland surveys in Parcels A, B, and C were subsequently conducted to provide more accurate identification of wetland location, acreage, type, and functionality within the parcels. Refer to Section 3.5.4 for more current information regarding wetlands in Parcels A, B, and C.

3.5.3.1 Habitat Types (FFWCC Land Cover Data)

The 1995 Florida Land Use and Cover Classification System (FLUCCS) data provided by the SFWMD was not sufficient to accurately identify the habitat types present in the EAA. The 1995 FLUCCS coding is either incomplete or does not contain the level of detail required for this project. Specifically, FLUCCS codes are only identified to Level II (the one exception being sugar cane at Level III) which does not provide an adequate description of the community types in the EAA. Therefore, the 1995 FLUCCS coding was not used to determine the habitat types present within the EAA. In most instances, the Florida Fish and Wildlife Conservation Commission's (FFWCC) Land Cover Data was used in this report to determine the presence and acreage of each land cover type occurring in the EAA. According to Randy Kautz (FFWCC, personal communication 2003), the FFWCC land cover map was generated using Landsat satellite data collected during 1999 and 2000 and accuracy was assessed using ground surveys and comparisons with other land cover data such as U.S. Geological Survey (USGS) soil maps, gap vegetation maps, and NWI maps.

A map presenting the FFWCC land cover classes in the EAA was generated (Figure 3) and the acreage and percentage of each land cover class was calculated for the EAA and WMAs (Table 3) and for Parcels A, B, and C (Table 4) (SFWMD 2003a). FFWCC land cover data acreages are reported in this section of the report with the exception of USACE and SFWMD estimates for aquatic (open water) acreage in Parcels A, B and C. In addition, it should be noted that the FFWCC land cover data acreage figures presented in the tables and below for the EAA and Parcels A, B, and C do not correspond to the

total acreages documented in the EAA Project Management Plan and reported earlier in this document (USACE 2003, SFWMD 2003a, SFWMD 2003b). This discrepancy is perhaps due to different methods used to calculate acreage.

Based on the FFWCC land cover data, the EAA encompasses 601,654 acres including the WMAs (64,659 acres). Twenty-five land cover classes are present within the entire EAA. It should be noted that land cover data are not yet available for 19,140 acres (3.1%) in the northeastern portion of the EAA. These areas are shaded gray on the land cover map and are not included in this land cover discussion.

According to the FFWCC's land cover data, the six major land cover classes that occur in the EAA include sugarcane (69%), bare soil/clearcut (12%), sawgrass marsh (7%), freshwater marsh/wet prairie (3%), shrub swamp (2%), and open water (2%). An additional 19 land cover types together comprise the remaining 8% of the EAA.

Based on the FFWCC land cover data, Parcels A, B, and C encompass a total of 53,655 acres (approximately 9% of the entire EAA) and include 18 land cover classes (Table 4) comprised primarily of sugarcane (74%) and bare soil/clearcut (22%). The additional 16 land cover types comprise the remaining 4% of these parcels.

3.5.3.2 Aquatic (Open Water)

The FFWCC aquatic land cover class includes canals and any depressional areas with an elevation low enough to allow standing water but do not have characteristics representative of wetlands. The aquatic habitats of the EAA are comprised of natural ponds and man-made drainage ditches and canals. The primary canals within the EAA are the Bolles, Cross, Hillsboro, Miami, North New River, and West Palm Beach Canals. These canals are considered Class III waters with a designated use of "recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife" (FDEP 2002).

The aquatic land cover class may include vegetative species such as spatterdock (*Nuphar* spp.), water hyacinth (*Eichhornia crassipes*), water lettuce (*Pistia stratiotes*), water lilies (*Nymphaea* spp.), American lotus (*Nelumbo lutea*), and musk grass (*Chara* spp.) (SFWMD 2003a).

The aquatic land cover class may include wildlife species such as the river otter (*Lontra canadensis*), West Indian manatee (*Trichechus manatus latirostris*), great blue heron (*Ardea herodias*), great egret (*Casmerodius albus*), other wading birds, osprey (*Pandion haliaetus*), American alligator (*Alligator mississippiensis*), bowfin (*Amia calva*), Florida gar (*Lepisosteus platyrhincus*), largemouth bass (*Micropterus salmoides floridanus*), and sunfish (*Lepomis* spp.) (SFWMD 2003a).

Based on the FFWCC land cover data, aquatic (open water) communities, including agricultural canals, comprise approximately 10,252 acres (2%) of the land cover within the EAA, of which, approximately 23 acres are located in the WMAs. Fairly large areas of open water are located in the northeastern and central portions of the EAA and moderate sized areas of open water are scattered throughout the EAA. In addition, concentrated areas of open water are present in STA-1W, STA-2, the southwest portion of STA-3/4, and the eastern portion of STA-5.

FFWCC land cover acreages for canals within Parcels A, B, and C were not available. Based on USACE and SFWMD estimates obtained from the interpretation of aerial photographs, open water comprises approximately 925 acres (1.7%) of the land cover in Parcels A, B, and C. Interior agricultural canals comprise approximately 907 acres of the land cover within the parcels, of which, approximately 583 acres are located in Parcel A, 141 acres in Parcel B, and 183 acres in Parcel C. The remaining 18 acres of open water occur as an inundated borrow pit in the west-central portion of Parcel B and is the only open water acreage presented in Table 4.

3.5.3.3 Uplands

Based on the FFWCC land cover data, uplands comprise approximately 487 acres (less than 0.1%) of the land cover within the EAA, of which, approximately 30 acres (6%) are located in the WMAs. Uplands comprise approximately 115 acres (less than 1%) of the land cover in Parcels A, B, and C. The upland land cover classes occurring in the EAA include dry prairie, hardwood hammocks and forests, pinelands, and mixed hardwood-pine forests.

Dry Prairie

Dry prairies are large areas of native grass and shrublands occurring on very flat terrain interspersed with scattered cypress domes and strands, bayheads, isolated freshwater marshes, and hardwood hammocks. The largest areas of these treeless plains historically occurred just north of Lake Okeechobee and were subject to annual or frequent fires. Many of these areas have been converted to improved pasture. This community is characterized by many species of grasses, sedges, herbs, and shrubs (Gilber and Stys, date unknown).

The dry prairie land cover class may contain vegetative species such as blueberry (*Vaccinium* spp.), bluestem (*Schizachyrium* spp.), carpet grass (*Axonopus* spp.), fetterbush (*Lyonia lucida*), gallberry (*Ilex glabra*), saw palmetto (*Serenoa repens*), staggerbush (*Lyonia fruticosa*), and wiregrass (*Aristida stricta*) (SFWMD 2003a).

The dry prairie land cover class may contain wildlife species such as the Florida panther (*Felis concolor coryi*), raccoon (*Procyon lotor*), common ground dove (*Columbina passerina*), eastern meadowlark (*Sturnella magna*), crested caracara (*Caracara cheriway*), and eastern indigo snake (*Drymarchon corais couperi*) (Gaea Crozier, SFWMD, personal communication 2003, SFWMD 2003a).

Based on the FFWCC land cover data, dry prairie comprises approximately 251 acres (less than 0.1%) of the land cover within the EAA. Of the 250 acres, approximately 8 acres (3%) are located in the WMAs. Small areas of dry prairie are located along the western boundary of the EAA.

Based on FFWCC land cover data, dry prairie comprises approximately 70 acres (0.1 percent) of the land cover in Parcels A, B, and C and is located in the central portion of Parcel B and the central and western portions of Parcel C.

Hardwood Hammocks and Forests

The hardwood hammocks and forests land cover class includes the major upland hardwood associations that occur statewide on fairly rich sandy soils. Variations in species composition, and the local or spatial distributions of these communities are due in part to differences in soil moisture regimes, soil type, and geographic location within Florida. The major variations within this association are mesic, xeric, and hydric hammocks (Gilbert and Stys, date unknown). Hydric hammocks are included in this FFWCC upland land cover class although the community may be considered a wetland. A description of each major hammock variety, and vegetative species that may be found there, are discussed below.

Mesic Hammocks

Mesic hammocks are closed canopy forests, dominated by temperate evergreen tree species that are naturally protected from fire by their position on the landscape. Tropical species are common in the shrub layer and become increasingly important in the canopy at the southern end of the range. Mesic hammocks may include vegetative species such as American holly, (*Ilex opaca*), blue beech (*Carpinus caroliniana*), cabbage palm (*Sabal palmetto*), eastern hophornbeam (*Ostrya virginiana*), laurel oak (*Quercus laurifolia*), southern magnolia (*Magnolia grandiflora*), and sweetgum (*Liquidambar styraciflua*) (SFWMD 2003a).

Xeric Hammocks

Xeric hammocks occur on deep, well-drained, sandy soils where fire has been absent for long periods of time. Xeric hammocks are open and dry and may include vegetative species such as blackjack oak (*Quercus marilandica*), bluejack oak (*Quercus incana*), live oak (*Quercus virginiana*), pignut hickory (*Carya glabra*), sand-live oak (*Quercus geminata*), and southern red oak (*Quercus falcata*) (SFWMD 2003a).

Hydric Hammocks

Hydric hammocks (live oak or cabbage palm hammocks) are relatively wet hardwood forests that occur on low, flat, and wet sites where the limestone may be near or at the surface. They may occur as mixed stands of oak and palm, or one species may completely dominate an area. These communities are saturated for long periods, often border large lakes and rivers, and may flood for short periods during the wet season. Hydric hammocks of the Florida peninsula may include vegetative species such as cabbage palm, live oak, blue beech, Florida elm (*Ulmus* spp.), red cedar (*Juniperus virginiana*), red maple (*Acer rubrum*), sweetgum, and water oak (*Quercus nigra*) (SFMWD 2003a).

The hardwood hammocks and forests land cover class may include wildlife species such as Florida black bear (*Ursus americanus floridanus*), Florida weasel (*Mustela frenata peninsulae*), white-tailed deer (*Odocoileus virginianus*), American swallow-tailed kite (*Elanoides forficatus*), bald eagle, and eastern indigo snake (SFWMD 2003a).

Based on the FFWCC land cover data, hardwood hammocks and forests comprise approximately 146 acres (less than 0.1%) of the land cover within the EAA, of which, approximately 21 acres (14%) are located in the WMAs. Small clusters of hardwood hammocks and forests appear to be found along the southern edge of Lake Okeechobee, in the central portion of the EAA between the Bolles Canal and Parcel A, and in the southern portion of the Rotenberger WMA.

Based on the FFWCC land cover data, hardwood hammocks and forests comprise approximately 27 acres (0.1%) of the land cover in parcels A, B, and C and are located in the central portion of Parcel B. Subsequent field surveys found no hardwood hammocks present in the parcels (see Section 3.5.4).

Pinelands

The pinelands category includes north and south Florida pine flatwoods and south Florida pine rocklands. Pine flatwoods occur on flat sandy terrain. Generally, flatwoods dominated by longleaf pine (*Pinus palustris*) occur on well-drained sites, while pond pine (*P. serotina*) is found in poorly drained areas and slash pine (*P. elliotti* var. *densa*) occupies intermediate or moderately moist areas. The understory and groundcover within these three communities are somewhat similar. Cypress domes, bayheads, titi swamps, and freshwater marshes are commonly interspersed in isolated depressions throughout this community type and fire is a major disturbance factor (Gilbert and Stys, date unknown).

The pinelands land cover class may include vegetative species such as bay (*Persea* spp.), fetterbush, gallberry, running oak (*Quercus pumila*), rusty lyonia (*Lyonia ferruginea*), saw palmetto, wax myrtle (*Myrica cerifera*), and wiregrass (SFWMD 2003a).

The pinelands land cover class may include wildlife species such as Florida black bear, Sherman's fox squirrel (*Sciurus niger*), bobwhite (*Colinus virginianus*), common grackle (*Quiscalus quiscula*), eastern bluebird (*Sialia sialis*), eastern kingbird (*Tyrannus tyrannus*), eastern meadowlark, loggerhead shrike (*Lanius ludovicianus*), northern cardinal (*Cardinalis cardinalis*), northern mockingbird (*Mimus polyglottos*), pine warbler (*Dendroica pinus*), red-bellied woodpecker (*Melanerpes Carolinus*), Bachman's sparrow (*Aimophila aestivalis*), black racer (*Coluber constrictor*), eastern indigo snake, gopher frog (*Rana capito*), green anole (*Anolis carolinensis*), southeastern five-lined skink (*Eumeces fasciatus*), and southern leopard frog (*Rana sphenoccephala*) (Gaea Crozier, SFWMD, personal communication 2003, SFWMD 2003a).

Based on the FFWCC land cover data, pinelands comprise approximately 89 acres (less than 0.1%) of the land cover within the EAA, of which, approximately 1 acre (1%) is located in the WMAs. Pinelands appear to be located in the central portion of the EAA between the Bolles Canal and Parcel A.

Based on the FFWCC land cover data, pinelands comprise approximately 18 acres (less than 0.1%) of the land cover in Parcels A, B, and C and exist in the central portion of Parcel B and in the central and western portions of Parcel C. Subsequent field surveys found no pinelands present in these parcels (see Section 3.5.4).

Mixed Hardwood-Pine Forests

The mixed hardwood-pine land cover class occurs mainly in clay soils. Younger stands may be predominantly pines, while a complex of various hardwoods become co-dominants as the system matures over time through plant succession (Gilbert and Stys, date unknown).

The mixed hardwood-pine land cover class may include vegetative species such as laurel oak, live oak, loblolly pine (*Pinus taeda*), longleaf pine, slash pine, sweetgum, and water oak (SFMWD 2003a).

The mixed hardwood-pine land cover class may include wildlife species such as cotton mouse (*Peromyscus gossypinus*), Florida mouse (*Podomys floridanus*), raccoon, Sherman's fox squirrel, white-tailed deer, pileated woodpecker (*Dryocopus pileatus*), red-bellied woodpecker, red-cockaded woodpecker (*Picoides borealis*), red-shouldered hawk (*Buteo lineatus*), eastern indigo snake, and gopher tortoise (*Gopherus polyphemus*) (SFWMD 2003a).

Based on the FFWCC land cover data, the mixed hardwood-pine forest class comprises less than 1 acre (a minute percentage) of the land cover within the EAA and is located in one extremely small area of mixed hardwood-pine forests along the western boundary of the EAA. This land cover class is not found in the WMAs or Parcels A, B, and C.

3.5.3.4 Disturbed Communities

The disturbed communities land cover class includes agricultural land categories such as sugarcane, citrus, row crops, improved pasture, unimproved pasture, and other agricultural land. Also included in this cover type are shrub and brushland and exotic plant communities. The various agricultural land cover classes were mapped as one class (agriculture) on the land cover map.

The disturbed community land cover class may include wildlife species such as raccoon, boat-tailed grackle (*Quiscalus major*), bobwhite, cattle egret (*Bubulcus ibis*), common grackle, crested caracara, eastern meadowlark, northern mockingbird, red-winged blackbird (*Agelaius phoeniceus*), white ibis (*Eudocimus albus*), box turtle (*Terrapene* spp.), and green anole (SFWMD 2003a).

Based on the FFWCC land cover data, disturbed communities comprise approximately 431,383 (70%) of the land cover in the EAA, of which, approximately 907 acres (less than 1%) are located in the WMAs. Disturbed communities comprise approximately 40,610 acres (76%) of the land cover in Parcels A, B, and C. Vegetation present in each cover type are discussed below.

Agricultural Land

Sugarcane

Based on the FFWCC land cover data, sugarcane comprises approximately 417,564 acres (69%) of the land cover within the EAA, of which, approximately 802 acres (less than 1%) are located in the WMAs. Sugarcane comprises approximately 39,711 acres (74%) of the land cover in Parcels A, B, and C.

Citrus

Based on the FFWCC land cover data, citrus comprises approximately 1,919 acres (less than 1%) of the land cover within the EAA. This land cover class is not found in the WMAs or Parcels A, B, and C.

Row Crops

Based on the FFWCC land cover data, row crops comprise approximately 918 acres (less than 1%) of the land cover within the EAA. This land cover class is not found in the WMAs. Row crops comprise approximately 635 acres (1%) of the land cover in Parcels A, B, and C.

Improved Pasture

Based on the FFWCC land cover data, improved pasture comprises approximately 1,612 acres (less than 1%) of the land cover within the EAA. This land cover class is not found in the WMAs or Parcels A, B, and C.

Unimproved Pasture

Based on the FFWCC land cover data, unimproved pasture comprises approximately 155 acres (less than 1%) of the land cover within the EAA. This land cover class is not found in the WMAs or Parcels A, B, and C.

Other Agricultural Land

The other agriculture land cover class would include the growth of rice and sod as well as unidentified agricultural uses, fallow cropland, aquaculture, specialty farms, nurseries, vineyards, and other groves besides citrus.

Based on the FFWCC land cover data, other agricultural land comprises approximately 8,512 acres (1%) of the land cover within the EAA, of which, 105 acres (approximately 1%) are located in the WMAs. Other agricultural land comprises approximately 167 acres (less than 1%) of the land cover in Parcels A, B, and C.

Shrub and Brushland

The shrub and brushland land cover class includes a variety of situations where natural upland community types have been recently disturbed through the clear-cutting of commercial pinelands, land clearing, or fire, and are recovering through natural successional processes. This land cover class could be characterized as an early condition

of old field succession. This community is dominated by various shrubs, tree saplings, and lesser amounts of grasses and herbs (Gilbert and Stys, date unknown).

The shrub and brushland land cover class may include vegetative species such as blackberry (*Rubus* spp.), bushy broomsedge (*Andropogon glomeratus*), dog fennel (*Eupatorium* spp.), elderberry (*Sambucus canadensis*), fetterbush, gallberry, various oaks and pines, saltbush (*Baccharis halimifolia*), saw palmetto, staggerbush, winged-sumac (*Rhus copallina*), and wax myrtle (*Myrica cerifera*) (SFWMD 2003a).

The shrub and brushland land cover class may include wildlife species such as the bobwhite, common grackle, northern mockingbird, northern cardinal, common yellowthroat (*geothylpis trichas*), white-eyed vireo (*Vireo griseus*), loggerhead shrike, red-bellied woodpecker, black racer, box turtle, and green anole (Gaea Crozier, SFWMD, personal communication 2003, SFWMD 2003a).

Based on the FFWCC land cover data, the shrub and brushland land cover class comprises 698 acres (less than 1%) of the land cover within the EAA. The shrub and brushland appear to be located in the north-central and northeastern portions of the EAA, within the urban areas located southeast of Lake Okeechobee, and along the southeastern boundary of the EAA. This land cover class is not found in the WMAs. Shrub and brushland comprises approximately 97 acres (less than 1%) of the land cover in Parcels A, B, and C and is located in the northeastern portion of Parcel A.

Exotic Plant Communities

Exotic plant communities are comprised of upland and wetland areas dominated by non-native vegetation that was planted or has escaped and invaded native plant communities.

The exotic plant communities land cover class may include vegetative species such as Australian pine (*Casuarina* spp.), Brazilian pepper (*Schinus terebinthifolius*), melaleuca (*Melaleuca quinquenervia*), and eucalyptus (*Eucalyptus* spp.).

Based on the FFWCC land cover data, exotic plant communities are shown to comprise only approximately 5 acres (a minute percentage) of the land cover in the EAA located along the northeastern boundary. Although the FFWCC exotic plant community as a separate land cover class encompasses a small amount of acreage within the EAA, exotic vegetation may be found throughout and/or dominate other EAA land cover classes.

Also, according to FFWCC land cover data, this land cover class is not present within the WMAs or Parcels A, B, and C. Subsequent field surveys of the parcels found exotic vegetation as the dominant species on many wetland areas (see Section 3.5.4).

3.5.3.5 Urban and Extractive Communities

The urban and extractive communities present within the EAA include bare soil/clearcut land, low impact urban land, high impact urban land, and extractive areas such as mining operations. On the land cover map, soil/clearcut and urban and extractive areas are grouped into a single category.

Based on the FFWCC land cover data, urban and extractive communities comprise approximately 86,541 acres (14%) of the land cover in the EAA, of which, approximately 188 acres (less than 1%) are located in the WMAs. Urban and extractive areas are concentrated south and southeast of Lake Okeechobee in the northern portion of the EAA (Belle Glade area). Urban and extractive communities comprise approximately 12,487 acres (23%) of the land cover in Parcels A, B, and C.

Bare Soil/Clearcut

The bare soil/clearcut land cover class represents areas of bare soil representing recent timber cutting operation, natural areas of exposed bare soil (e.g. sandy areas within xeric communities), or bare soil exposed due to vegetation removal for unknown reasons (Gilbert and Stys, date unknown).

The bare soil/clear cut land cover class may include wildlife species such as the Florida burrowing owl (*Speotyto cunicularia floridana*), black vulture (*Coragyps atratus*), turkey vulture (*Carthartes aura*), boat-tailed grackle, cattle egret, and white ibis (SFMWD 2003a).

Based on the FFWCC land cover data, the bare soil/clearcut land cover class comprises approximately 72,285 acres (12%) of the land cover in the EAA, of which, approximately 42 acres (less than 1%) are located in the WMAs. The bare soil/clearcut land cover class comprises approximately 12,018 acres (22%) of the land cover in Parcels A, B, and C.

Low Impact Urban

This land cover class represents disturbed areas within urbanized areas that may or may not be vegetated, such as lawns, golf courses, road shoulders, and grassy areas surrounding open areas such as airports and park facilities.

The low impact urban land cover class may include wildlife species such as raccoon, opossum (*Didelphis marsupialis*), bobwhite, common grackle, northern mockingbird, boat-tailed grackle, osprey, white ibis, gopher tortoise, and southeastern five-lined skink (Gaea Crozier, SFWMD, personal communication 2003, SFWMD 2003a).

Based on the FFWCC land cover data, the low impact urban land cover class comprises approximately 8,404 acres (1%) of the land cover in the EAA, of which, approximately 36 acres (less than 1%) are located in the WMAs. The low impact urban land cover class comprises approximately 221 acres (less than 1%) of the land cover in Parcels A, B, and C.

High Impact Urban

The high impact urban land cover class represents unvegetated sites within urban areas such as roads, buildings, and parking lots. Wildlife usage of these sites would generally be low and could include birds such as the common grackle, boat-tailed grackle, turkey vulture, and black vulture.

Based on the FFWCC land cover data, the high impact urban land cover class comprises approximately 5,851 acres (less than 1%) of the land cover in the EAA, of which, approximately 110 acres (2%) are located in the WMAs. The high impact urban land cover class comprises approximately 248 acres (less than 1%) of the land cover in Parcels A, B, and C.

Extractive Areas

This land cover class may include areas that encompass surface and subsurface mining operations (phosphate mines, limestone quarries, and sand, gravel, and clay pits). Industrial complexes where the extracted material is refined, packaged, or further processed may also be included in this category.

Based on the FFWCC land cover data, the extractive land cover class comprises less than 1 acre (a minute percentage) of the land cover in the EAA. This land cover class is not found in the WMAs or Parcels A, B, and C.

3.5.3.6 EAA Wetland Data and Preliminary Wetland Data for Parcels A, B, and C

Accurate wetland information is required in order to evaluate the impacts associated with proposed alternatives for the Alternative Evaluation and the Plan Formulation Process for the EAA Project. This section presents available wetland information for the EAA and preliminary data and analyses for wetlands present in Parcels A, B, and C (SFWMD 2003a). Based on field surveys, a more accurate description of wetland location, acreage, type, and habitat function within Parcels A, B, and C is discussed in Section 3.5.4.

Section 3.5.3.6.1 describes FFWCC land cover data for wetland communities and acreages within the EAA, WMAs, and Parcels A, B, and C. Representative vegetation and wildlife associated with each community are also presented. Due to the lack of information regarding wetlands present in Parcels A, B, and C, Section 3.5.3.6.2 describes various data and methods employed to determine potential wetland locations

and acreages within the parcels (SFWMD 2003a). A comparison of acreage analyses in the EAA and in Parcels A, B, and C is discussed in Section 3.5.3.6.3.

3.5.3.6.1 Wetlands (FFWCC Land Cover Data)

Wetlands are areas where water covers the soil, or is present either at or near the surface of the soil, for all or part of the year. Wetlands have characteristic soils, water saturation (hydrology), and plant species. The extended water presence supports the development of distinctive wetland (hydric) soils. The hydrology largely determines the types of plant and animal communities living in and on the soil. Wetlands may support vegetation more commonly associated with water (aquatic species), land (terrestrial species), and/or facultative species that are adapted to both aquatic and terrestrial communities. Wetlands usually support the growth of plants that are particularly adapted to wet conditions (hydrophytes).

Changes in physiography, hydrology, land use practices, and other factors have led to the formation of a diverse assemblage of wetlands within the historical Everglades. Isolated wetlands have no apparent surface water connection to perennial rivers and streams, estuaries, or the ocean. Isolated wetlands of the former Everglades floodplain were once inundated by seasonal sheet flows but, due to changes in topography, are now left isolated beyond the active floodplain (SFWMD 2003a). In other cases, the isolation of former floodplain wetlands has been caused by construction of levees or dikes to provide flood protection and manage flow regimes. Many other isolated wetlands have been produced by human activities for a variety of reasons including aesthetic appreciation, livestock watering, irrigation, aquaculture, and stormwater management. In addition, isolated wetlands may have been created by fragmentation resulting from encroaching development. The majority of wetlands within the EAA represent remnants of once larger wetland complexes.

Wetlands drained for any purpose belong to other land use categories, such as agriculture or residential land uses. If these areas are re-established with wetland vegetative cover,

they are again classified as wetlands. Included in the FFWCC wetland land cover class are lowland coniferous, deciduous, and mixed forests, along with non-forested wetlands (emergent vegetation), and non-vegetated wetlands.

The FFWCC land cover data provides the most accurate wetland information available for the EAA, as discussed in Section 3.5.3.6.3. Based on the FFWCC land cover data and maps, wetlands comprise approximately 72,993 acres (12%) of the land cover within the EAA, of which, approximately 63,511 acres (87%) are contained within the WMAs. The wetland land cover classes occurring in the EAA include sawgrass marsh, freshwater marsh and wet prairie, cattail marsh, shrub swamp, hardwood swamp, wetland forested mixed, cypress swamp, and cypress/pine/cabbage palm. Following the FFWCC land cover class protocol, hydric hammocks are not included as wetlands, but are discussed in Section 3.5.3.3 as part of the upland Hardwood Hammocks and Forests land cover community (SFWMD 2003a).

The FFWCC land cover data provides preliminary estimates of wetland acreage in Parcels A, B, and C and is included in this section for comparison with acreage reported for the entire EAA. Recent field studies conducted within the parcels provide more accurate wetland acreage (see Section 3.5.4). Based on FFWCC land cover data, wetlands comprise approximately 424 acres (less than 1%) of the land cover in Parcels A, B, and C.

Sawgrass Marsh

Sawgrass marsh communities are dominated by sawgrass (*Cladium jamaicensis*). In natural conditions, the dense sawgrass inhibits the growth of other vegetation. In addition to sawgrass, this land cover class may include vegetative species such as muhly grass (*Muhlenbergia capillaris*), pickerelweed (*Pontederia cordata*), and plume grass (*Erianthus* spp.) (SFWMD 2003a).

Dense areas in the sawgrass marsh land cover class may include wildlife species such as the common yellowthroat, red-winged blackbird, boat-tailed grackle, American bittern

(*Botaurus lentigenosis*), least bittern (*Ixobrychus exilis*), king rail (*Rallus elegans*), and sora (*Porzana carolina*), while more open areas may also include the Everglades snail kite (*Rostrhamus sociabilis plumbeus*), apple snail (*Pomacea paludosa*), great blue heron, wood stork (*Mycteria americana*), and other wading birds (Gaea Crozier, SFWMD, personal communication 2003, SFWMD 2003a).

Sawgrass marsh communities generally occur south of Lake Okeechobee in the historic Everglades basin. Based on the FFWCC land cover data and map, sawgrass marsh comprises approximately 39,411 acres (7%) of the land cover within the EAA, of which, 36,712 acres (93%) are contained within the WMAs. Sawgrass marsh also occurs in the eastern portion of STA-2.

Based on the FFWCC land cover data, sawgrass marsh comprises approximately 9 acres (less than 1%) of the land cover in Parcels A, B, and C and is located on the border between Parcel B and STA-2. Subsequent field surveys found sawgrass present in some wetlands including the littoral area (shoreline) of the borrow pit in west-central Parcel B. However, sawgrass was not the dominant species in any of the parcel wetlands (see Section 3.5.4).

Freshwater Marsh and Wet Prairie

Freshwater Marsh

Freshwater marshes are dominated by a wide assortment of herbaceous plant species growing on sand, clay, marl, and organic soils in areas of variable water depths and inundation regimes. Generally, freshwater marshes occur in deeper, more strongly inundated situations and are characterized by tall emergents and floating-leaved species (Gilbert and Stys, date unknown).

Wet Prairie

In south Florida, wet prairies commonly occur on low, flat, and poorly drained terrain and grade into wet and mesic flatwoods and marshes or into dry and marl prairies. Wet prairie communities are treeless with vegetation comprised predominantly of grasses,

sedges, and forbs on hydric soils. Compared to freshwater marshes, wet prairies generally have less water, shorter vegetation, are drier for longer periods, and support a greater diversity of plants. Wet prairies may contain areas of open water and support masses of flowering plants during all seasons.

Wet prairies support abundant native plant and animal life, including many endangered and threatened species. Because they are surrounded by other types of habitat such as dry prairies, flatwoods, hammocks, and swamps, wet prairies are used by neighboring species as well (Gilbert and Stys, date unknown).

The freshwater marsh and wet prairie land cover class may include vegetative species such as arrowhead (*Sagittaria* spp.), alligator flag (*Thalia* spp.), bulrush (*Scirpus* spp.), buttonbush (*Cephalanthus occidentalis*), cattail (*Typha* spp.), common reed (*Phragmites* spp.), giant duckweed (*Spirodela polyrhiza*), maidencane (*Panicum hemitomon*), softrush (*Juncus effusus*), sawgrass, spatterdock, spike rush (*Eleocharis* spp.), swamp lily (*Crinum americanum*), water hyacinth, whitetop sedge (*Dichromena colorata*), and yellow-eyed grass (*Xyris ambigua*) (SFWMD 2003a).

The freshwater marsh and wet prairie land cover class may include wildlife species such as the marsh rabbit (*Sylvilagus palustris*), raccoon, river otter, American coot (*Fulica americana*), anhinga (*Anhinga anhinga*), red-winged blackbird, double-crested cormorant (*Phalacrocorax auritus*), great blue heron, great egret, green heron (*Butorides virescens*), little blue heron (*Egretta caerulea*), snowy egret (*Egretta thula*), tricolored heron (*Egretta tricolor*), white ibis, wood stork, osprey, red-shouldered hawk, Everglades snail kite, limpkin (*Aramus guarauna*), common moorhen (*Gallinula chloropus*), green tree frog (*Hyla cinerea*), southern leopard frog, American alligator, Florida cooter (*Pseudemys floridana*), pygmy rattlesnake (*Sistrurus miliarius*), water moccasin (*Agkistrodon piscivorus*), Florida gar, mosquitofish (*Gambusia affinis*), and bluefin killifish (*Lucania goodei*), (Gaea Crozier, SFWMD, personal communication 2003, SFWMD 2003a).

Based on the FFWCC land cover data, freshwater marsh and wet prairie together comprise approximately 16,637 acres (3%) of the land cover in the EAA, of which, 12,150 acres (73%) are contained within the WMAs. The freshwater marsh and wet prairie cover class appears to be concentrated in the central portion of STA-2 and throughout the WMAs. This land cover type is also found clustered along the eastern and western borders of the EAA and scattered throughout the EAA in very small clusters.

Based on the FFWCC land cover data, freshwater marsh and wet prairie comprise approximately 293 acres (less than 1%) of the land cover in Parcels A, B, and C, primarily in the central and western portions of Parcels B and C. Subsequent field surveys found freshwater marsh areas in all parcels (see Section 3.5.4).

Cattail Marsh

Cattail marshes are dominated by southern cattail (*Typha domingensis*) and/or common cattail (*Typha latifolia*). Cattails are native in the Everglades and were historically found in small clumps around concentrations of natural nutrient inputs such as alligator holes and bird roosts. However, due to water quality degradation (predominantly excess phosphorus) within the Everglades, the historical range of cattails has expanded. Cattails are able to displace sawgrass and other marsh vegetation in areas with elevated phosphorus levels and may be considered nuisance vegetation (SFWMD 2003a).

In addition to the above-mentioned cattail species, the cattail marsh land cover class may include similar plant and wildlife species as those found in sawgrass and freshwater marshes.

Based on the FFWCC land cover data, cattail marsh comprises approximately 4,676 acres (less than 1%) of the land cover within the EAA, of which, 4,247 acres (91%) are contained within the WMAs. The cattail marshes appear to be concentrated in the Holey Land WMA, the southwestern portion of the Rotenberger WMA, and the southern corner of STA-6.

Based on FFWCC land cover data, cattail marsh comprises approximately 18 acres (less than 1%) of the land cover in Parcels A, B, and C. This cover type appears to be located in small clusters in the southern and western portions of Parcel C. Subsequent field surveys found cattail present in some wetlands in Parcel C although not as the dominant species (see Section 3.5.4).

Shrub Swamp

Shrub swamps are wetland communities dominated by dense, low-growing, woody shrubs or small trees. Shrub swamps are usually characteristic of wetland areas that are experiencing environmental change and are early to mid-successional in species complement and structure. These changes are a result of natural or man-induced perturbations due to increased or decreased hydroperiod, fire, clear cutting, land clearing, and siltation. Shrub swamps in Florida may be dominated by one species or an array of opportunistic plants may form a dense, low canopy (Gilbert and Stys, date unknown).

The shrub swamp land cover class may include vegetative species such as buttonbush (*Cephalanthus occidentalis*), red maple (saplings), sweetbay (*Magnolia virginiana*), wax myrtle, and Carolina willow (*Salix caroliniana*). Exotic shrub species that may be present include Brazilian pepper and primrose willow (*Ludwigia peruviana*) (SFWMD 2003a).

The shrub swamp land cover class may include wildlife species such as the Florida panther, marsh rabbit, raccoon, white-tailed deer, various wading birds, American coot, anhinga, red-winged blackbird, common grackle, boat-tailed grackle, common yellowthroat, northern cardinal, northern mockingbird, white-eyed vireo, palm warbler (*Dendroica palmarum*), yellow-rumped warbler (*Dendroica coronata*), prothonotary warbler (*Protonotaria citrea*), red-bellied woodpecker, red-shouldered hawk, limpkin, wood duck (*Aix sponsa*), rough green snake (*Opheodrys aestivus*), eastern indigo snake, water moccasin, southern toad, and mosquitofish (Gaea Crozier, SFWMD, personal communication 2003, SFWMD 2003a).

Based on the FFWCC land cover data, shrub swamp comprises approximately 10,958 acres (2%) of the land cover within the EAA, of which, 9,454 acres (86%) are contained within the WMAs. Shrub swamp appears to be concentrated in the central portion of STA-2, the southern corner of STA-6, and throughout the WMAs.

Based on FFWCC land cover data, shrub swamp comprises approximately 79 acres (less than 1%) of the land cover in Parcels A, B, and C and is located in small concentrated areas along the western boundary of Parcel B and in the northwestern portion of Parcel C. Subsequent field studies found shrub swamp present in all parcels (see Section 3.5.4).

Hardwood Swamp

Hardwood swamps are wooded wetland communities composed of either pure stands of hardwoods or a mixture of hardwoods and cypress (*Taxodium* spp.). This association of wetland-adapted trees occurs throughout Florida on organic soils (Gilbert and Stys, date unknown).

This land cover class may include vegetative species such as black gum (*Nyssa sylvatica* var. *biflora*), bald cypress (*Taxodium distichum*), cabbage palm, dahoon holly (*Ilex cassine*), red maple, swamp ash (*Fraxinus* spp.), sweetbay, and water tupelo (*Nyssa aquatica*) (SFWMD 2003).

The hardwood swamp land cover class may include similar wildlife species to those found in shrub swamps.

Based on the FFWCC land cover data, hardwood swamp comprises approximately 1,138 acres (less than 1%) of the land cover within the EAA, of which, approximately 948 acres (83%) are contained within the western portions of Holey Land WMA, the northern portion of the Rotenberger WMA, and the southern portion of STA-6.

Based on FFWCC land cover data, hardwood swamp comprises approximately 22 acres (less than 1%) of the land cover in Parcels A, B, and C as very small clusters in the

western portion of Parcel B and the southern portion of Parcel C. Subsequent field surveys found no hardwood swamps present in the parcels (see Section 3.5.4).

Wetland Forested Mixed

Wetland hardwood forests are those wetland areas that have a minimum of 10% crown closure of which 66% or more is dominated by wetland hardwoods. No single species dominates this community type. Younger stands may be predominantly pines, while a complex of various hardwoods become co-dominants as the system matures over time through plant succession. In this land cover class, neither the hardwoods nor conifers achieve dominance. The mix of species can include hardwoods with pine or cypress and can represent a mixed hydric site or a transition between hardwoods and conifers on hydric/mesic sites (Gilbert and Stys, date unknown).

This land cover class may include vegetative species such as American beech (*Fagus grandifolia*), American holly, dogwood (*Cornus* spp.), loblolly pine, mockernut hickory (*Carya tomentosa*), red maple, shortleaf pine (*Pinus echinata*), southern red oak, water hickory (*Carya aquatica*), water oak, and water tupelo (SFWMD 2003a).

The wetland forested mixed land cover class may include wildlife species such as cotton mouse, Florida mouse, raccoon, Sherman's fox squirrel, Florida black bear, barred owl (*Strix varia*), pileated woodpecker, red-cockaded woodpecker, eastern indigo snake, Florida gopher frog, and those species found in shrub swamps and hardwood swamps (SFWMD 2003a).

Based on FFWCC land cover data, wetland forested mixed land cover comprises approximately 25 acres (a minute percentage) of the land cover within the EAA and is not found in the WMAs. This land cover class appears to be located in very small areas along the western portion of the EAA and the southern portion of STA-6.

Based on FFWCC land cover data, wetland forested mixed comprises approximately 1 acre (a minute percentage) of the land cover in Parcels A, B, and C, and is only found in

the central portion of Parcel C. Subsequent field surveys found no wetland forested mixed present in the parcels (see Section 3.5.4).

Cypress Swamp

Cypress swamps are regularly inundated wetlands that form a forested border along large rivers, creeks, and lakes, or occur in depressions as circular domes or linear strands. The canopy consists of bald cypress, or pond cypress (*Taxodium ascendens*). This land cover class may also include vegetative species such as black gum, buttonbush, red maple (saplings), and sweetbay (SFWMD 2003a). The understory and ground cover are usually sparse due to frequent flooding (Gilbert and Stys, date unknown).

The cypress swamp cover class may include similar wildlife species as found in shrub swamps and hardwood swamps.

Based on the FFWCC land cover data, cypress swamp comprises approximately 139 acres (less than 1%) of the land cover within the EAA. The majority of the cypress swamp land cover appears to be concentrated in the western portion of STA-5, the southern portion of STA-6, and in the northwestern portion of the EAA. This land cover class is not found in the WMAs.

Based on the FFWCC land cover data, cypress swamp comprises approximately 2 acres (a minute percentage) of the land cover in Parcels A, B, and C and exists only in the central portion of Parcel C. Subsequent field surveys found no cypress swamps present in the parcels although cypress domes were observed west of Parcel C (see Section 3.5.4).

Cypress/Pine/Cabbage Palm

This community includes cypress, pines, and/or cabbage palms in combination with other species. None of these species achieves dominance. The community forms a transition between moist upland and hydric sites (Gilbert and Stys, date unknown).

The predominant vegetative species in this land cover class include bald cypress, pond cypress, cabbage palm, longleaf pine, pond pine, and slash pine, with other species similar to those found in cypress swamps, hardwood swamps, and wetland forested mixed (SFWMD 2003a).

The cypress/pine/cabbage palm land cover class may include wildlife species similar to those found in cypress swamps, hardwood swamps, and wetland forested mixed.

Based on the FFWCC land cover data, cypress/pine/cabbage palm land cover comprises approximately 9 acres (a minute percentage) of the land cover within the EAA and appears to be located in very small areas scattered throughout the western portion of STA-5. This land cover class is not found in the WMAs.

Based on FFWCC land cover data, this class is not found in Parcels A, B, or C. Subsequent field studies also found no presence of this class within the parcels (see Section 3.5.4).

3.5.3.6.2 Potential Wetlands in Parcels A, B, and C

Potential wetland identification and mapping analyses of Parcels A, B, and C were performed to locate potential wetlands within the parcels (SFWMD 2003a). Infrared satellite images and NWI maps (Figure 4) were evaluated. In addition, soil maps (Figure 2) and USGS 7.5 minute series topographic maps (Figures 5a-5d) were used to determine depressional areas that may also indicate the presence of a wetland (SFWMD 2003a).

Infrared Satellite Imagery

Infrared satellite images (1999) were evaluated using ArcView GIS software (version 3.2) to identify, map, and determine the acreage of potential wetland areas within Parcels A, B, and C (SFWMD 2003a). In addition to the potential wetlands within the parcel, wetlands located within a 2,000-foot buffer zone surrounding each parcel were also mapped. Those wetlands located within the portions of the 2,000-foot buffer zone that

fall within an existing or future STA or the Holey Land and Rotenberger WMAs were not mapped. As mentioned previously, the naturally occurring vegetation in the EAA has been, to a large extent, replaced by agricultural crops. Depressional areas in the satellite images on which crops appeared were not identified as wetlands. As expected, the infrared images indicated that potential wetlands located within the EAA appear to be isolated and depressional.

NWI Map

To assist in determining potential wetland sites in Parcels A, B, and C, an NWI map (Figure 4) was generated for Parcels A, B, and C (SFWMD 2003a) using the FWS's NWI data, distributed in the FGDL (FGDL 2000). The resulting NWI map is based on 1972 aerial photographs (with one exception of 1984). The NWI wetland classification system is hierarchical, with wetlands and deepwater habitats divided among five major systems at the broadest level and into classes and subclasses at lower levels.

In the entire EAA, the NWI codes U (Uplands) and PSS3/EM5C (Palustrine, Scrub-Shrub, Broad-Leaved Evergreen, Emergent, Seasonally Flooded) comprise the highest percentages, approximately 79% and 15%, respectively (Table 5). An additional 46 NWI codes together comprise the remaining 6% of the EAA. Table 6 presents the NWI codes occurring in Parcels A, B, and C. The NWI codes U and PSS3/EM5C also comprise the highest percentages within the parcels, approximately 73% and 25%, respectively. An additional six NWI codes together comprise the remaining 2% of this area.

Potential Wetland Acreage Calculations Within Parcels A, B, and C

Due to limitations available in data sets and the lack of field verification, field studies were required in Parcels A, B, and C to determine wetland status. The preliminary data and maps discussed below provided background information for the field study. The field-verified wetland locations, acreage, type, and functional value are discussed in Section 3.5.4

The potential wetland mapping analysis based on infrared, NWI, soil, and topographic maps, identified a total of 265 potential wetland polygons including 245 within Parcels A, B, and C and 20 within the 2,000-foot buffer zone (SFWMD 2003a). The 265 potential wetland polygons comprise an area of approximately 1,954 acres. Figures 6a-6d depict the potential wetlands identified in Parcels A, B, and C (including buffer areas) and Table 7 presents the acreage of each of the potential wetlands. The potential wetland polygons range in size from approximately 0.1 to 506 acres.

Based on the preliminary analysis, 118 potential wetlands totaling approximately 455 acres were mapped within Parcel A (SFWMD 2003a). Within the 2,000-foot buffer zone, an additional five potential wetlands totaling over 2 acres were mapped. Thus, the total acreage of potential wetlands within Parcel A (including those wetlands in the 2,000-foot buffer) is 458 acres. This is approximately 23% of the 1,954 acres of potential wetlands identified within all parcels.

Based on the preliminary analysis, 35 potential wetlands totaling approximately 351 acres were mapped within Parcel B (SFWMD 2003a). This is approximately 18% of the 1,954 acres identified within all parcels. No wetlands were in the 2,000-foot buffer zone.

Based on the preliminary analysis, 92 potential wetlands totaling approximately 328 acres were mapped within Parcel C (SFWMD 2003a). Within the 2,000-foot buffer zone, an additional 15 potential wetlands totaling approximately 817 acres were mapped. Thus, the total acreage of potential wetlands within Parcel C (including those wetlands in the 2,000-foot buffer) is 1,145 acres. This is approximately 59% of the 1,954 acres identified within all parcels.

3.5.3.6.3 Comparison of Wetland Acreage Estimates

Wetland coverage estimates were gathered from FFWCC land cover data, NWI data, and the potential wetland identification and mapping analysis described above. As

demonstrated in the chart below, wetland acreage estimates from each of these sources vary.

Source	Wetland Estimate for EAA	Wetland Estimate for Parcels A, B, and C
FFWCC Land Cover Data (FFWCC, date unknown-a)	72,990 acres	424 acres
NWI Data (FGDL, 2000)	128,959 acres	14,660 acres
Potential Wetland Mapping Analysis	N/A	1,954 acres

Wetland Acreage Estimates for the EAA

The FFWCC land cover data of 72,990 wetland acres in the EAA is likely to be the more accurate estimate as it is based on years 1999 and 2000 aerial photographs with a resolution of 30m by 30m (900m² or 0.22 acres). NWI data most likely overestimates the wetland acreage due to the determinations being made from less recent 1972 aerial photographs (with one exception of 1984) and previous wetlands that may have been converted into agricultural land or other land uses.

Preliminary Wetland Acreage Estimates for Parcels A, B, and C

The NWI data, which again provide the highest estimate of 14,660 acres, most likely generate the least accurate estimate of wetland acreage in Parcels A, B, and C. The FFWCC land cover data acreage of 424 is based on more recent 1999 and 2000 aerial photographs. The potential wetland acreage analysis estimate of 1,954 in Parcels A, B, and C refers only to potential wetland sites; therefore, all polygons identified are not expected to be wetlands. The potential wetland analysis result is 1,530 acres greater than the FFWCC estimated acreage and 12,706 acres less than that estimated by the NWI map. Due to the discrepancies in available wetland acreage data, a field survey was conducted to obtain more accurate estimates of the number, location, acreage, type, and

functionality of wetlands in Parcels A, B, and C. The results are discussed in Section 3.5.4.

3.5.4 Wetland Field Survey of Parcels A, B, and C

As discussed in Section 3.5.3.2, available information was not sufficient to ascertain accurate number, location, acreage, type, and habitat functionality of wetlands within Parcels A, B, and C. Therefore, aerial and ground wetland surveys were performed by an interagency ecological team of EAA Project biologists representing the FWS, USACE, SFWMD, US Environmental Protection Agency (USEPA), FFWCC, and Florida Department of Environmental Protection (FDEP).

3.5.4.1 Wetland Verification/Characterization

Methodology

The map of potential wetlands in Parcels A, B, and C (Figures 6a-6d) was used as a reference to conduct a wetland verification survey, *i.e.*, to verify whether the polygons identified on the map were actually wetlands. The 196 potential wetlands chosen for the survey included all polygons within the parcel boundaries that were greater than or equal to 0.5 acres in size. Polygons smaller than 0.5 acres were not surveyed due to their lower functional value. In addition, buffer areas adjacent to the parcels were not surveyed as the land is not part of the project footprint.

Using ArcView GIS software, each polygon to be verified was assigned a number based on the smallest to largest acreage (Figures 7a-7c). Fourteen polygons in the western buffer area of Parcel C (outside the parcel) were inadvertently included on the numbered maps but were not included in the verification process. Ground surveys were performed to verify/characterize polygons that were adjacent to, or near, accessible levees. Aerial surveys were performed for all potential wetland polygons in order to verify polygons that were inaccessible and to estimate the extent and type of dominant vegetative cover in each wetland detected. Verified wetlands were characterized as to type (category) of

wetland based on the vegetative species present. The ecological team spent a total of three days in the field conducting the on-ground survey and logged approximately 20 hours of aerial observation via helicopter.

Results

Based on the results of ground and aerial surveys, six distinct categories of wetlands were identified in the parcels. The categorization was based on the percentage of woody, herbaceous, native, and exotic/nuisance vegetation present in the wetlands. Exotic vegetation are non-native species that were planted or have escaped and invaded native plant communities. Nuisance vegetation are native species that do not belong in the community or have replaced more appropriate native vegetation. Although exotic and nuisance species are generally considered less desirable than native species, the exotic/nuisance dominated wetlands provide some habitat value for fish and wildlife (see Section 3.5.4.2).

Category	Vegetation
1	Native Herbaceous Dominated (<20% Shrub)
2	Native Mixed Herbaceous (20% to 49% Shrub)
3	Exotic/Nuisance Shrub Dominated (<20% Herbaceous)
4	Exotic/Nuisance Mixed Shrub (20% to 49% Herbaceous)
5	Exotic/Nuisance Herbaceous Dominated (<20% Shrub)
6	Exotic/Nuisance Mixed Herbaceous (20% to 49% Shrub)

Category 1 wetlands, Native Herbaceous Dominated (<20% Shrub), consist of over 80% native herbaceous vegetation such as maidencane, sagittaria, and pickerelweed (*Pontederia cordata*). Category 2 wetlands, Native Mixed Herbaceous (20% to 49% Shrub), consist of approximately 51% to 80% native herbaceous species. Category 3 wetlands, Exotic/Nuisance Shrub Dominated (<20% Herbaceous), consist of over 80% exotic and/or nuisance shrub vegetation such as primrose willow, Brazilian pepper, and

baccharis. Category 4 wetlands, Exotic/Nuisance Mixed Shrub (20% to 49% Herbaceous), consist of approximately 51% to 80% exotic and/or nuisance shrub species. Category 5 wetlands, Exotic/Nuisance Herbaceous Dominated (<20% Shrub), consist of over 80% exotic and/or nuisance herbaceous vegetation such as torpedo grass (*Panicum repens*), paragrass (*Urochloa mutica*), and limpo grass (*Hemarthria altissima*). Category 6 wetlands, Exotic/Nuisance Mixed Herbaceous (20% to 49% Shrub), consist of approximately 51% to 80% exotic and/or nuisance herbaceous species.

Comparing the six categories outlined above to the FFWCC land cover classes discussed in Section 3.5.3.2.6, categories 1 and 5 would be considered freshwater marsh, category 3 would be considered shrub swamp, and categories 2, 4, and 6 would best be described as a combination of both freshwater marsh and shrub swamp. Other FFWCC wetland land cover classes were not found within the parcels but may exist within the remainder of the EAA as described in Section 3.5.3.2.6. For the purposes of this report, wetlands dominated by exotic/nuisance vegetation in the parcels are not compared to the FFWCC exotic plant communities land cover class due to the overriding wetland characteristics.

Of the 196 potential wetland polygons visited in Parcels A, B, and C during ground and/or aerial verification surveys, 89 wetlands totaling 598.47 acres were identified. Table 8 provides the parcel, wetland identification number, category, acreage, date flown, and longitude and latitude for each wetland identified. A summary by parcel is demonstrated in the chart below.

Wetland Results	Parcel A	Parcel B	Parcel C	All Parcels
Total Wetlands / Acres	5 / 205.88	2 / 76.97	82 / 315.62	89 / 598.47
Cat 1 Wetlands / Acres	1 / 13.07	1 / 9.51	8 / 21.24	10 / 43.82
Cat 2 Wetlands / Acres	N/A	N/A	6 / 42.97	6 / 42.97

Cat 3 Wetlands / Acres	1 / 1.73	N/A	12 / 55.96	13 / 57.69
Cat 4 Wetlands / Acres	N/A	1 / 67.46	18 / 70.93	19 / 138.39
Cat 5 Wetlands / Acres	1 / 3.45	N/A	23 / 74.54	24 / 77.99
Cat 6 Wetlands / Acres	2 / 187.63	N/A	15 / 49.98	17 / 237.61

Based on the verification/characterization analysis, five wetlands are present in Parcel A encompassing 205.88 acres with wetland sizes ranging from 1.73 to 106.38 acres (Table 8). Wetlands in Parcel A comprise approximately 6% of the total number of wetlands and 34% of the total acreage of wetlands in all parcels. The wetlands are distributed into categories 1, 3, 5, and 6. Two of the wetlands, A-80 and A-81, are smaller than depicted on the potential wetland map (approximately 37% of the areas adjacent to the western levee are not wetland) and the smaller acreage is reflected in Table 8. One of the polygons identified on the map, A-75, is actually two distinct wetlands that belong to separate categories (A-75a is the western portion and occupies approximately 67% of the polygon with A-75b to the east). Of the 81 potential wetland polygons visited, 77 are not wetlands and are either being farmed for sugar cane or are bare patches surrounded by sugar cane. No additional wetlands were observed during the ground and aerial verification surveys of all polygons in Parcel A.

Based on the verification/characterization analysis, two wetlands are present in Parcel B encompassing 76.97 acres (Table 8). Wetlands in Parcel B comprise approximately 2% of the total number of wetlands and 13% of the total acreage of wetlands in all parcels. Of the 35 potential wetland polygons visited, only one polygon (B-30) is a wetland. B-30 is 67.46 acres in size and is a category 4 wetland. The remaining 34 polygons are not wetlands and are either being farmed for sugar cane, being farmed for sod, or are bare rocky soil. During the aerial flights, an additional wetland was located in Parcel B. The wetland is a healthy littoral zone (shore area), 9.51 acres in size, and surrounds an 18 acre

borrow pit inundated with water. Historically the borrow pit was mined for rock, subsequently used as a fish nursery, and currently provides no human resource function (William Tarr, Okeelanta Corporation, personal communication 2003). The littoral zone is a category 1 wetland.

Based on the verification/characterization analysis, Parcel C contains the largest number of wetlands and the largest total wetland acreage of all parcels. There are 82 wetlands in Parcel C encompassing approximately 315.62 acres with wetland sizes ranging from 0.58 to 30.76 acres (Table 8). Wetlands in Parcel C comprise approximately 92% of the total number of wetlands and 53% of the total acreage of wetlands in all parcels. All six categories of wetlands are represented in Parcel C. Two of the polygons identified on the map, C-92 and C-93, are both actually two distinct wetlands and belong to separate categories (C-92a is the southern portion and occupies approximately 80% of the polygon with C-92b to the north; C-93a is the western portion and occupies approximately 50% of the polygon with C-93b to the east). Although it appeared portions of wetland C-66 had recently been plowed under, the entire polygon was included in the verification survey as wetland species had begun returning to the area. Of the 84 potential wetland polygons visited in Parcel C (86 polygons including both 93a and 93b, and 92a and 92b), four were not wetlands but were bare patches, piles of rubble, or were being farmed for sugar cane (C-3, C-6, C-27, and C-84). Although polygon C-84 was being farmed for sugar cane, three excavated open water areas (totaling approximately 2 acres) were observed within the field, but were not included as wetlands as they are similar to the open water portion of the borrow pit in Parcel B and the agricultural canals. No additional wetlands were observed during the ground and aerial verification surveys in Parcel C.

Of the 49,901 acres present in all parcels (USACE 2002), wetland acreage identified during the verification survey comprises approximately 1.20% of the total area. Of the 31,495 acres present in Parcel A (USACE 2002), wetlands comprise approximately 0.65% of the total area and, of the 9,522 acres present in Parcel B, wetlands comprise approximately 0.81% of the total area. By comparison, Parcel C contains the least land

acreage of all parcels (8,884 acres) but possesses the largest percentage of wetland acreage (3.55%).

Approximately 64% of the wetlands in Parcels A, B, and C are dominated by herbaceous species (categories 1, 2, 5 and 6), accounting for 67% of the total wetland acreage. The remaining 36% of the wetlands are dominated by shrub/overstory species, accounting for 33% of the total wetland acreage. Although they are not always the dominant vegetation type, shrub/overstory species occur to some extent in almost all wetlands.

Approximately 18% of the wetlands in Parcels A, B, and C are dominated by native vegetation (categories 1 and 2) and the remaining 82% are dominated by exotic and/or nuisance vegetation. Similarly, approximately 15% of wetland acreage in the parcels is dominated by native vegetation and 85% by exotic and/or nuisance vegetation. Category 2 wetlands are found only in Parcel C. The majority of native vegetation in all categories is composed of herbaceous species that offer little vertical structure for wildlife such as birds. Therefore, the majority of shrub vegetation offering vertical structure in all categories is composed of exotic and/or nuisance species. Although exotic vegetation is generally considered less desirable than native vegetation, the habitat structure that exotics provide may still serve a valuable role for wildlife (see Section 3.5.4.2).

Three of the exotic species found in the wetlands (Brazilian pepper, paragrass, and torpedo grass) are classified by the Florida Exotic Pest Plant Council's (EPPC) as Category I exotic species. Category I species invade and disrupt native plant communities in Florida. This definition does not rely on the economic severity or geographic range of the problem, but on the documented ecological damage caused. Three additional exotic species found in the wetlands (limpo grass, elephant ear [*Xanthosoma sagittifolium*], and alligatorweed [*Alternanthera philoxeroides*]) are classified as EPPC Category II species. Category II species have demonstrated potential to disrupt native plant communities and may become Category I species in the future.

Comparison of Wetland Acreage Estimates

The approximately 599 acres of wetlands identified during the verification survey in Parcels A, B, and C differ from previous estimates described in Section 3.5.3.6. FFWCC land cover data indicates approximately 424 acres of wetland within the parcels, NWI data estimates approximately 14,660 acres, and the potential wetland mapping analysis estimates 1,954 acres. Of the three preliminary estimates for Parcels A, B, and C, the total wetland acreage (599) obtained by the field survey most closely resembles the FFWCC land cover data estimate (a difference of 175 acres). The FFWCC land cover data encompasses approximately 71% of the wetland acreage identified during the field survey of the parcels.

The FFWCC land cover data reports approximately 72,993 acres of wetlands within the entire EAA (Section 3.5.3.6.1). Including the additional 175 acres of wetlands identified in Parcels A, B, and C during the verification survey, the FFWCC EAA wetland acreage increases to approximately 73,168 acres. Wetland verification of the remaining EAA lands would more accurately portray wetland acreage for the entire EAA and is recommended.

3.5.4.2 Wetland Habitat Functional Analysis

The wetland habitat functional analysis may serve as a baseline of current wetland conditions, as a basis of comparison for both the “Future Without Project” and “Future With Project” alternatives, and aid in determining locations for the proposed reservoirs. To determine the functionality of wetland habitats within Parcels A, B, and C, the interagency team of EAA Project biologists identified the appropriate protocol, prepared background information, and performed an on-site wetland habitat assessment.

Methodology

The Wetland Rapid Assessment Procedure (WRAP) (Miller and Gunsalus 1999) was chosen to determine the wetland function for the existing condition in Parcels A, B, and C. The WRAP methodology, an analysis originally created to evaluate mitigation debits

and credits, is commonly used to account for changes in wetland function for Everglades restoration projects in south Florida (USFWS 2001).

The WRAP procedure, in combination with professional judgment, establishes a numerical ranking for six individual ecological and human factors (variables) that can strongly influence wetland function. The numerical output for the variables is then used to evaluate current wetland condition. If a variable is not applicable to the wetland, the variable is omitted. The variable scores are summed for each wetland and then divided by the total possible maximum score for the variables, resulting in the final WRAP score expressed as a number between zero and one. The WRAP score is then multiplied by the acreage of the wetland polygon to derive “Functional Units” of the wetlands for comparison purposes.

Due to the large number and inaccessibility of wetlands in Parcel C, the ecological team performed WRAP surveys on a representative sample of wetlands from each of the 6 categories. The representative wetlands were chosen based on accessibility, geographical location to ensure wetlands were sampled throughout the parcel, and vegetation category to ensure at least one wetland from each category was surveyed (Section 3.5.4.1). Resulting WRAP scores for wetlands in Parcel C belonging to the same category were averaged. The average score was subsequently applied to all wetlands in Parcel C belonging to the associated category. Two wetlands in Parcel A (A-80 and A-81) were assigned the associated average category WRAP score evaluated in Parcel C due to the inaccessibility of the sites and the lack of other wetlands of the same category within Parcel A. The ecological team spent a total of six days in the field conducting the WRAP survey including one day in Parcel A, one day in Parcel B, and four days in Parcel C.

During on-site surveys of each wetland, six WRAP variables were evaluated and given numerical scores when applicable. Evaluating the first variable, wildlife utilization, the team detected the presence of wildlife by observing species directly, identifying species via listening for vocalizations (such as birdsong and frog calls), and through observing the presence of signs such as tracks, scat, rubs, nests, burrows, bedding areas, shells, and

other remnant exoskeletons. Dip nets and seine nets were used where appropriate to detect fish and other aquatic wildlife. Evaluating the second variable, wetland overstory/shrub canopy, the team rated the presence, health, and appropriateness of wetland shrub and overstory canopy. The presence of exotic and nuisance species significantly lowers the score for this variable and exotic/nuisance shrub and groundcover estimates were quantified during on-ground and aerial surveys. Evaluating the third variable, wetland vegetative groundcover, the team rated the presence, abundance, appropriateness, and condition of vegetative ground cover (herbaceous species) within each wetland. Evaluating the fourth variable, adjacent upland/wetland buffer, the team rated the size, ecological attributes, and landscape setting of the area adjacent to the wetland. Evaluating the fifth variable, wetland hydrology, the team rated the hydrologic regime by observing and interpreting the amount of standing water present, vegetative indicators such as water lines on trees, encroachment of transitional species, connectivity to canals and/or other wetlands, and the presence of aquatic organisms and shells. Evaluating the sixth variable, water quality input and treatment, the team inferred the quality of the surface water flowing into the wetland by observing adjacent land uses and connectivity to other water sources. Wetlands that were bermed and/or apparently received all water via rainfall generally receive a higher water quality score than those directly connected to agricultural land and/or canals.

Results

As mentioned above, six variables were used to determine the overall WRAP scores for each of the 19 wetlands surveyed. The results are summarized below. Attachment C includes the individual WRAP field data sheets providing complete information pertaining to each variable and the WRAP score for each wetland.

Wildlife Utilization

Wildlife species or signs observed in Parcels A, B, and C include: 1) invertebrates such as beetles, dragonflies, spiders, mosquitoes, fire ants, and aquatic snails; 2) fish such as mosquitofish, sunfish, gar, and largemouth bass; 3) amphibians such as pig frogs (*Rana grylio*), tree frogs, and amphiuma; 4) reptiles such as skinks, water moccasins, and

alligators; 5) birds such as the white-eyed vireo, boat-tailed grackle, red-winged blackbird, green heron, and red-shouldered hawk; and 6) mammals such as white-tailed deer, marsh rabbit, gray fox (*Urocyon cinereoargenteus*), and river otter. Table 9 provides a complete listing of fish and wildlife species directly observed or determined by analyzing signs within the parcels. In general, more wildlife species were observed in wetlands containing both herbaceous and shrub vegetation as compared to wetlands dominated by one or the other type of vegetation.

During the verification surveys in Parcels A and B, two unexpected species were observed (the white-tailed kite [*Elanus caeruleus*] and Florida burrowing owl) although they were not directly located within a wetland. Two white-tailed kites were observed flying over the central portion of Parcel B. White-tailed kite sightings are unusual in south Florida (Gaea Crozier, SFWMD, personal communication 2003).

Directly west of potential wetland polygon B-27 in the northern section of Parcel B, five Florida burrowing owls and four burrows were observed (80 35.4797 W longitude, 26 25.8498 N latitude). A survey of the surrounding area found an additional owl near polygon B-18 although there was no evidence of a burrow (80 34.925 W longitude, 26 25.296 N latitude). The owls in Parcel B were observed in previously farmed sod fields that appear to be too rocky for continued farming. Two Florida burrowing owls were also observed in Parcel A in a recently planted field (80 41.56 W longitude, 26 27.454 latitude). Although there were no additional sightings of Florida burrowing owls, owls may be present in other locations that provide similar habitat and camouflage within Parcels A, B, and C. Florida burrowing owls are not considered a federally listed species but are included in the federal Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703-712), and are listed as a species of special concern by the State of Florida. If reservoirs are to be sited in the general area of Florida burrowing owl habitat, MBTA and State regulations will apply as appropriate.

Agricultural canals are located throughout the parcels and are estimated to make up 583 acres in Parcel A, 141 acres in Parcel B, and 183 acres in Parcel C (see Section 3.5.3.2).

Although, for the purposes of this report, these canals are considered open water and are not included in the WRAP survey, they contain littoral and submerged aquatic vegetation and provide habitat for fish and wildlife. During the WRAP survey, the ecological team noted the presence and relative “function” of the canals in each parcel. The majority of canals in Parcel B are rocky, steep, appear to be highly managed, and possess little vegetation although fish species were observed in some areas. Parcel A canals appear to be generally larger than those found in Parcel B and possess greater amounts of vegetation and potential fish and wildlife habitat. Canals in Parcel C appear to be the most desirable among the parcels for potential fish and wildlife habitat, fish and wildlife species observed, and amount of littoral area present. In addition, rim ditches surrounding many individual wetlands in Parcel C provide habitat for fish and wildlife, as well as perhaps serving as recruitment and refugia areas during dry, and subsequent reflooded, conditions within the wetlands. The 18 acre inundated borrow pit in Parcel B provides habitat for aquatic fish and wildlife and the three open water areas in polygon C-84 may also provide fish and wildlife habitat.

Wetland Overstory/Shrub Canopy

Wax myrtle, elderberry, and buttonbush are the most common native overstory species that are not considered nuisance vegetation in Parcels A, B, and C. However, these species are not found in large quantities within the parcels. The most common native shrubs present in the parcel wetlands, such as baccharis (*Baccharis* spp.) and Carolina willow, are considered nuisance species as they are invasive and transitional. The majority of overstory vegetation in the parcels is composed of exotic and/or nuisance species. Therefore, scores tended to be low for this variable. The most common exotic/nuisance shrub species in the wetlands are Brazilian pepper, primrose willow, baccharis, and Carolina willow. Table 10 provides a complete listing of overstory species observed within the parcels.

Wetland Vegetative Groundcover

Groundcover in the wetlands of Parcels A, B and C includes vegetative species present in herbaceous dominated wetlands as well as groundcover species located below, and/or in conjunction with, shrub and canopy species. Within the parcels, native herbaceous dominated wetlands (categories 1 and 2) include species such as maidencane, arrowhead, pickerelweed, climbing hempvine (*Mikania scandens*), Virginia buttonweed (*Diodia virginiana*), and creeping cucumber (*Melothria pendula*). Exotic/nuisance herbaceous dominated wetlands include species such as torpedo grass (*Panicum repens*), paragrass (*Urochloa mutica*), limpo grass (*Hemarthria altissima*), common dayflower (*Commelina diffusa*), giant foxtail (*Setaria faberi*), and elephant ear (*Xanthosoma sagittifolium*) (categories 5 and 6). Most herbaceous dominated wetland vegetation and understory vegetation contain a combination of both native and exotic/nuisance species. Table 10 provides a complete listing of groundcover species observed within the parcels.

Adjacent Upland / Wetland Buffer

The majority of land adjacent to the wetlands in Parcels A, B and C is actively being farmed for sugarcane. Other sites adjacent to wetlands are low-quality vegetative areas such as embankments of levees or canals. Therefore, scores for this variable were low for all wetlands in all parcels with the exception of wetlands that were adjacent to each other (A-75a and A-75b; C-92a and C92b; C-93a and C-93b).

Wetland Hydrology

In Parcels A, B, and C, the ability of the wetlands to hold water primarily appears to be based on hydrological connectivity and the degree of elevation, *i.e.*, more depressional areas hold water for a longer period of time. Hydrology of the wetlands in the parcels generally fits into one of four main types: 1) wetlands possessing a perimeter berm, thus being mainly rainfall driven systems; 2) wetlands directly adjacent to a perimeter rim ditch, thus receiving rainfall and possibly experiencing seepage into or out of the wetland; 3) wetlands possessing a perimeter berm either inside or outside of a perimeter rim ditch, thus being mainly rainfall driven systems with some degree of seepage possible, and 4) wetlands directly adjacent to farmlands or other terrestrial areas, thus

receiving direct rainfall and adjacent area runoff. In wetland areas that appeared to be dry, other indicators such as vegetation type, water marks on trees and shrubs, and the presence of aquatic macroinvertebrate exoskeletons (such as snail shells) revealed clues to hydrology.

A representative of the U.S. Sugar Corporation (personal communication 2003) advised that the rim ditches around observed wetlands were dredged by the agricultural landowners to protect areas designated as wetlands by the SFWMD, USACE, and the Natural Resources Conservation Service (NRCS) and to serve as avoidance markers to farm personnel. The center line of each rim ditch was placed 10 feet from the edge of the wetland and the ditch was dredged 3-4 ft deep and 4-5 feet wide. Berms located inside and/or outside of rim ditches are primarily due to ditch excavation activities. Although the agencies did not allow the agricultural canals already running through the designated wetlands to be filled in, the rim ditches and resulting berms prevent connections to adjacent agricultural drainage ditches and canals. For any wetland designated by the NRCS, agricultural drainage ditches were required to be at least 200 feet away from the wetland. For all other designated wetlands, drainage ditches were allowed to be 30 feet away from the rim ditch. Wetland areas within Parcel C that do not possess rim ditches are areas that were not designated wetlands by the above agencies and are not being farmed due to being too wet and/or depressional. Berms around these wetland areas are incidental or were placed as avoidance markers. In addition, rim ditches in Parcel C were also placed around Native American cultural resource sites (mounds) identified by agencies.

From observations obtained during the Verification and Habitat Evaluation surveys, the edge of the wetlands appear to have expanded to the edge of the rim ditches in most wetlands. Although the rim ditches serve to protect the wetlands from adjacent areas, there appears to be potential for the rim ditches and wetlands to be inundated with water when adjacent agricultural fields are flooded or during extreme rainfall events, thereby affecting the wetland hydrology. However, in these instances, a perimeter berm in

conjunction with a rim ditch may provide a better barrier to inundation of a wetland than when a berm is not present.

Water Quality Input and Treatment

Performing water quality tests was not feasible during the WRAP survey of Parcels A, B, and C. Therefore, water quality parameters were assessed using WRAP protocol methods and best professional judgment. Water quality indicators were directly related to the four main types of hydrological connectivity discussed in the Wetland Hydrology variable above. Wetlands completely surrounded by a berm and/or rimmed by a ditch are primarily rainfall-driven areas and generally received the highest water quality scores due to a lower potential for nutrient-laden runoff into the wetlands. Both a berm and a rim ditch around a wetland may increase protection of wetland water quality by providing an additional barrier to runoff from adjacent land, particularly when adjacent fields are flooded or during extreme rainfall events. Alternatively, wetlands directly adjacent to farmlands or other terrestrial areas generally received lower water quality scores due to higher potential to receive nutrient-laden runoff.

WRAP and Functional Unit Scores

Of the 19 wetlands surveyed, three wetlands were in Parcel A, two in Parcel B, and 14 in Parcel C. Attachment C provides individual WRAP field data sheets and Table 11 provides a summary of WRAP variable scores. The charts below provide a summary of wetlands that were included in the WRAP survey and the vegetation category and WRAP score of each. Refer to Figures 7a-7c to identify exact locations of the wetlands included in the WRAP.

Parcel A

Parcel-Wetland	Vegetation Category	WRAP Score
A-78	1	0.50
A-75b	3	0.36
A-75a	5	0.40

Parcel B

Parcel-Wetland	Vegetation Category	WRAP Score
B-Borrow Pit Littoral Zone	1	0.50
B-30	4	0.38

Parcel C

Parcel-Wetland	Vegetation Category	WRAP Score
C-46	1	0.50
C-48	1	0.50
C-61	1	0.50
C-37	2	0.40
C-93a	2	0.44
C-75	3	0.39
C-96	3	0.46
C-55	4	0.46
C-66	5	0.31
C-62	5	0.32
C-30	6	0.35
C-63	6	0.39
C-87	6	0.43
C-89	6	0.35

As discussed in the methodology section above, WRAP scores for wetland categories in Parcel C were averaged and are presented in the chart below.

Parcel C

Vegetation Category	Number of Wetlands Sampled	Average WRAP Score	Native/Exotic Dominated
1	3	0.50	Native
2	2	0.42	Native
3	2	0.43	Exotic
4	1	0.46	Exotic
5	2	0.32	Exotic
6	4	0.38	Exotic

As may be expected due to the predominance of native vegetation, category 1 (Native Herbaceous Dominated) received the highest average WRAP score. The slightly higher score of category 3 (Exotic/Nuisance Shrub Dominated) as compared to category 2 (Native Mixed Herbaceous) is mainly a result of higher wetland canopy and wildlife utilization variable scores for wetland C-96 due to the greater percentage of overstory habitat. The slightly higher score of category 4 (Exotic/Nuisance Mixed Herbaceous) as compared to category 2 is mainly a result of higher wetland groundcover and wildlife utilization variable scores for wetland C-55, primarily due to greater diversity of groundcover vegetative species. It should be noted that only one wetland in category 4 was included in the field survey due to lack of accessibility of other category 4 wetlands in Parcel C.

The averaged category WRAP scores from the field survey were subsequently applied to all wetlands in Parcel C that belong to the associated category. For example, wetland C-35 was not among the wetlands sampled during the WRAP survey but was determined a category 5 wetland during the verification survey. Therefore, C-35 received the average category 5 WRAP score of 0.32. For consistency and future comparison purposes, the appropriate average category WRAP score was applied to each wetland in Parcel C including those that were part of the original WRAP survey, rather than reporting the actual WRAP score for field-surveyed wetlands. The average wetland score for category 6 in Parcel C (0.38) was also applied to wetlands A-80 and A-81 based on their vegetation characteristics and because WRAP scores for this type of wetland were unavailable from Parcel A.

Functional Units are the final scores reported in a WRAP survey and serve as an indicator of wetland function. Functional Units in the parcels were determined by multiplying the WRAP score (A-78, A-75a, A75b, B-30, and B-Borrow Pit Littoral Zone) or averaged category WRAP score (Parcel C, A-80, and A-81) of each wetland by the individual wetland acreage. Table 12 identifies each wetland and the associated WRAP score and Functional Unit score. The “Existing Condition” Functional Unit scores presented in this

report will be used as a baseline for comparing “Future Without Project” and “Future With Project” alternatives.

The chart below provides a summary of the Functional Units by vegetation category for each parcel. Functional Units are rounded off to the nearest whole number for ease of comparison.

Parcel – Category	Number of Wetlands	WRAP Score	Acres	Functional Units
Parcel A – Cat 1	1	0.50	13.07	7
Parcel A – Cat 3	1	0.36	1.73	1
Parcel A – Cat 5	1	0.40	3.45	1
Parcel A – Cat 6	2	0.38*	187.63	71
Parcel B – Cat 1	1	0.50	9.51	5
Parcel B – Cat 4	1	0.38	67.46	26
Parcel C – Cat 1	8	0.50	21.24	11
Parcel C – Cat 2	6	0.42	42.97	18
Parcel C – Cat 3	12	0.43	55.96	24
Parcel C – Cat 4	18	0.46	70.93	33
Parcel C – Cat 5	23	0.32	74.54	24
Parcel C – Cat 6	15	0.38	49.98	19

*** Used Parcel C Category-6 Wrap Score for Parcel A Category-6**

The wetland Functional Unit score for all parcels combined is approximately 240. A total of 80 wetland Functional Units are present within Parcel A which represents approximately 33% of the total Functional Units of all parcels. The highest functional score for a single wetland among all parcels is in Parcel A (A-81) with 40 Functional Units and the second highest is also in Parcel A (A-80) with 31 Functional Units. This is primarily due to the two wetlands being the largest found in any of the 3 parcels (106.38 acres and 81.25 acres, respectively).

A total of 31 wetland Functional Units are present within Parcel B which represents 13% of the total Functional Units of all parcels. The third highest functional score for a single

wetland among all parcels is in Parcel B (B-30) with 26 Functional Units, primarily because it is the third largest wetland present within the parcels (67.46 acres).

A total of 129 wetland Functional Units are present within Parcel C, which represents 54% of the total Functional Units of all parcels. Parcel C has the fourth highest functional score for an individual wetland (C-96) with 13 Functional Units and the fourth highest acreage (30.76).

As above, the Functional Unit score ranking for the four largest wetlands seems to be heavily influenced by their size. However, this does not seem to hold true for the remaining, smaller wetlands.

Herbaceous dominated wetlands (categories 1, 2, 5, and 6) account for approximately 65% of the Functional Units for all wetlands within the parcels, and shrub dominated wetlands account for the remaining 35%. These figures are similar to those found during the verification process for the number and acreage of wetlands dominated by herbaceous and shrub species (Section 3.5.4.1). The Functional Unit score per acre of herbaceous dominated wetland is 0.39. As may be expected due to higher diversity of vegetative species and/or more abundant vertical habitat, the functional score per acre of shrub dominated wetland is 0.43.

Wetlands dominated by native species account for 17% of the total Functional Units for all wetlands within the parcels, and wetlands dominated by exotic/nuisance species account for the remaining 83%. However, as expected, the Functional Unit score per acre of wetland dominated by native species is approximately 0.47 which is higher than the 0.39 Functional Units per acre for wetlands dominated by exotic/nuisance species.

3.5.4.3 Conclusions

Comparing Parcels A, B, and C using the data derived from the verification/characterization analysis and the wetland habitat functional analysis

(WRAP), the highest total wetland Functional Unit score is found in Parcel C. Parcel C also contains the largest total wetland acreage, largest number of wetlands, largest percentage of wetland acreage, and greatest distribution of wetlands scattered throughout the entire parcel. A small number of wetlands are located in the central and eastern portions of Parcel A and in the west-central portion of Parcel B. Although the three largest wetlands are located in Parcels A and B, the wetlands are predominantly composed of exotic vegetative species. In comparison, 88% of all native dominated wetlands are located in Parcel C. Also of note, most wetlands in Parcel C are protected by rim ditches and thus experience less impact from surrounding areas.

Based on these analyses, if EAA Phase 1 and Phase 2 project goals and objectives can be met, it would be more ecologically beneficial to construct the reservoirs in Parcels A and B. Additional ecological benefits may be gained, and/or ecological negative impacts lessened, if wetland areas can be avoided in all parcels. Expanding the existing wetland footprints or further protecting wetlands within parcels would also provide additional ecological benefit. Of note, the presence of Florida burrowing owls will need to be appropriately addressed on known sites in Parcels A and B and where encountered elsewhere within all parcels.

3.5.5 Fish and Wildlife

Native habitat for fish and wildlife does not comprise a significant amount of the EAA as the alteration of the landscape for agricultural uses has resulted in the removal of nearly all previously occurring native vegetation. Remaining wetlands provide some native habitat but are isolated and fragmented throughout the EAA (see Section 3.5.3.6). Although the native habitat has been altered, fish and wildlife species are known to utilize the EAA (Lodge 1996, Section 3.5.4.2).

There is a lack of published research of fish and wildlife species present in the EAA, although several studies have been completed and/or are in progress. Various unpublished studies such as a 1996 report, indicate EAA habitat opportunities for fishes,

wading birds, shore birds, and ducks (Lodge 1996, SFWMD 2003a). Although abundant wetland habitat has been replaced by agriculture, the creation of ditches, canals, rice paddies, and the flooding of fallow agricultural fields during the rainy season provide some habitat for fish and other aquatic wildlife. In addition, these habitats provide attractive foraging habitat for birds, particularly during the rainy season (Lodge, 1996). However, displacement of fish and wildlife species due to conversion of wetland areas to agriculture has not been intensively studied. In addition, studies were not available relating to the potential effects of elevated nutrient levels (such as phosphorus) and contaminant levels (such as mercury and pesticides) to fish and wildlife within the EAA.

Based on a 1996 unpublished report, the EAA has the potential to contain 32 species of mammals, 55 species of fish, 148 taxa of invertebrates, 21 native and 3 introduced species of amphibians, and 35 species of reptiles (Lodge, 1996). Detailed lists of fish and wildlife that may occur in vegetative community types present in the EAA can be found in Myers and Ewel's *Ecosystems of Florida* (1990). Fish and wildlife that may inhabit FFWCC designated land cover classes in the EAA are discussed in Section 3.5.3 of this report. Fish and wildlife species observed in Parcels A, B, and C during field surveys conducted for this report, are discussed in Section 3.5.4.2.

Known and potentially occurring fish and wildlife species within the EAA and Parcels A, B, and C are discussed below. Following PIR guidelines, this report separates the discussion of general fish and wildlife from those species that are federally and state listed as threatened and endangered. Therefore, although federally and state listed species are included in this section, discussion of listed species is presented in Section 3.5.6. Many of the reports and databases presented in this section will also be used to describe listed species.

3.5.5.1 Representative Wildlife Species in the EAA

A representative list of potentially occurring fish and wildlife species in the EAA was compiled by using a variety of sources and is presented in Table 13 (SFWMD 2003a). A

list of potentially occurring bird species in the EAA based upon a combination of scientific data, documented sightings, and casual field observation was compiled by Elise Pearlstine (University of Florida) and the FWS and is presented in Table 14. A brief summary of the representative species contained in Tables 13 and 14 include: mammals such as bobcat (*Lynx rufus*), cotton mouse, eastern gray squirrel (*Sciurus carolinensis*), eastern yellow bat (*Lasiurus intermedius*), Florida panther, white-tailed deer, opossum, raccoon, and round-tailed muskrat (*Neofiber alleni*); birds such as mottled duck (*Anas fulvigula*), ring-necked duck (*Aythya collaris*), ruddy duck (*Oxyura jamaicensis*), American black duck (*Anas rubripes*), bald eagle, black vulture, turkey vulture, blue jay (*Cyanocitta cristata*), boat-tailed grackle, cattle egret, great egret, white ibis, wood stork, common yellowthroat, killdeer (*Charadrius vociferous*), long-billed dowitcher (*Limnodromus scolopaceus*), and tree swallow (*Tachycineta bicolor*); reptiles and amphibians such as American alligator, cottonmouth, eastern indigo snake, rat snake (*Elaphe obsoleta*), green anole, eastern mud turtle (*Kinosternon subrubrum*), striped mud turtle (*Kinosternon bauri*), southern leopard frog, and pig frog; and fish such as bowfin, Florida gar, largemouth bass, golden topminnow (*Fundulus chrysotus*), bluefin killifish, and mosquitofish. Section 3.5.3 of this report describes ecological communities that may be present in the EAA and potential fish and wildlife species that may inhabit each community type.

The National Oceanographic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS) was contacted on March 18, 2003 concerning Essential Fish Habitat (EFH) designations for canals (SFWMD 2003a). According to NMFS, there is no EFH designation for the canals in the EAA as they are located landward of salinity control devices. The NMFS also stated that the South Atlantic Fisheries Management Council does not manage the anadromous fish species that may occupy these areas (species that spend a majority of their adult lives in salt water, and migrate to freshwater to reproduce).

3.5.5.2 Representative Wildlife Species in Parcels A, B and C

Fish and wildlife species observed in Parcels A, B, and C during field surveys conducted for this report are presented in Table 9 and discussed in Section 3.5.4.2. Attachment C contains fish and wildlife species observed in the specific isolated wetland locations surveyed, as well as other information regarding functionality of each wetland.

3.5.5.3 GIS Data Pertaining to Fish and Wildlife Resources

The following sections discuss GIS data sets containing information pertaining to the fish and wildlife resources and ecologically sensitive areas of the EAA and Parcels A, B, and C. These data indicate rookery locations, areas of quality habitat, areas utilized by rare and protected species, and areas of high biodiversity. This information may be used to assist in the alternative evaluation process and in identifying potential reservoir location by indicating areas that, if selected, may have a greater impact on fish and wildlife. It should be noted that several species discussed below as occurring in the EAA may only occur in a minute portion of the EAA or, more commonly, occur in buffer zone areas and/or areas adjacent to the EAA. Please refer to the indicated maps to locate species occurrence and/or predicted occurrence.

3.5.5.3.1 Species Occurrence Databases

The FFWCC 1987-1993 Wildlife Observation Database (FFWCC 2003b), updated continuously, and the FNAI Element Occurrences Database (date unknown), last updated June 2002, were reviewed to identify verified listed and non-listed species occurrences within the EAA and surrounding area (SFWMD 2003a). These databases were searched for the entire EAA and an additional 2,000-foot buffer outside of the EAA boundary. It should be noted that the results of the database reviews may not be representative of the entire EAA as much of the species occurrence data appears to have been collected via surveys along major levees rather than within the EAA interior.

Data obtained from these databases were added to the list of bird observations in the EAA compiled by the Elise Pearlstine (University of Florida) and FWS. The results are provided in Table 15 and presented in tabular format with respective sources identified. Entries from the bird observation table list the FWS as the “Data Source”. All other observations were obtained from the FFWCC and FNAI databases. Federally and state listed species identified are discussed in Section 3.5.6.2.1.

3.5.5.3.2 FFWCC Breeding Bird Atlas and Wading Bird Rookeries

FFWCC Breeding Bird Atlas (BBA)

The FFWCC Breeding Bird Atlas (BBA) includes data collected between 1986 and 1991 (Endries *et al.*, 2001). The basic grid for the BBA was established by the quadrangles of the USGS topographic maps of Florida. Each quadrangle was divided into 6 equal parts (blocks) with each block containing approximately 7,000 acres. A minimum of two blocks per quadrangle were field surveyed and at least 25 field hours were spent in each block surveying for bird species and associated breeding observations. Each survey observation was associated with one of 20 breeding codes. GIS maps representing these survey data were generated by the FFWCC using ArcInfo software (FFWCC 2003a).

For the BBA observations within the EAA, over 1,700 records are available (Endries *et al.*, 2001). Because of the extensive number of records, this information has not been included in its entirety. Rather, breeding bird species maps were generated to display species distribution (SFWMD 2003a) and are included in Attachment D. Each colored area on the map represents species presence observed within that block.

Based on the FFWCC BBA survey data, 221 bird species were recorded in Florida during the survey. Of these records, 96 bird species were recorded in the EAA. Table 16 provides a list of each of the 96 species, the listing status, and the number of blocks in which the species was present.

Of the 96 species observed in the EAA, species maps representing the survey data were available for 22 bird species. The 22 species include the southeastern American kestrel (*Falco sparverius paulus*), American swallow-tailed kite, bald eagle, black rail (*Laterallus jamaicensis*), black skimmer (*Rhynchops niger*), black-crowned night-heron (*Nycticorax nycticorax*), yellow-crowned night-heron (*Nyctanassa violacea*), Florida burrowing owl, crested caracara, Everglades snail kite, Florida sandhill crane (*Grus canadensis*), great egret, hairy woodpecker (*Picoides villosus*), least bittern, limpkin, little blue heron, mottled duck, osprey, red-cockaded woodpecker, snowy egret, tricolored heron, and wild turkey (*Meleagris gallopavo*). Federally and state listed species identified and mentioned above are discussed in Section 3.5.6.2.2

FFWCC Wading Bird Rookeries

The FFWCC Wading Bird Rookeries data (FFWCC, date unknown-b) provide the general location of known wading bird rookeries in Florida. This data was reviewed to identify rookeries located in the EAA and in Parcels A, B, and C (SFWMD 2003a). The database contains survey data (activity status and nesting species) and associated observation dates for a FFWCC rookery survey conducted January through July 1999. The database also provides the activity status for each rookery in the FFWCC's 1980s survey (1986 through 1989) and 1970s survey (1976 through 1978).

Three wading bird rookeries are identified in the EAA although no wading bird rookeries are identified in Parcels A, B, and C (SFWMD 2003a). Table 17 contains the survey data for these rookeries. Figure 8 depicts the location of the wading bird rookeries identified by the database. Under appropriate conditions, wading birds inhabiting rookeries located in natural areas near the EAA such as WCA-1, WCA-2, and WCA-3A, may forage on EAA lands during nesting season. None of the species observed in the FFWCC Wading Bird Rookery database are federally listed species although state listed species are present, mentioned below, and discussed in Section 3.5.6.2.2.

The first rookery, observed on April 15, 1999, is located west of the North New River Canal, between Lake Okeechobee and the Bolles Canal. This rookery was occupied by

50-250 nesting pairs of anhingas, great egrets, little blue herons, tricolored herons and cattle egrets.

The second rookery, observed on April 20, 1999, is located in the southwestern portion of Lake Okeechobee, north of the Miami Canal. This rookery contained less than 50 nesting pairs and was occupied by anhingas, great blue herons, and great egrets.

The third rookery, observed on April 20, 1999, is located just south of the Hillsboro Canal, just east of the canal's intersection with the North New River Canal. This rookery contained 50-250 nesting pairs and was occupied by great egrets, little blue herons, and white ibis.

3.5.5.3.3 FFWCC Integrated Wildlife Habitat Ranking System

The FFWCC Integrated Wildlife Ranking System (Endries *et al.*, 2001) assigned ranks ranging from 1 to 10 for each land cover class represented in both the EAA and in Parcels A, B, and C (SFWMMD 2003a). The ranking system is intended to assist in long-range planning efforts by targeting sensitive or rare habitats. A rank of 1 indicates the lowest relative habitat value, while a rank of 10 indicates the highest relative habitat value. A map of the habitat values, depicted in a graduated color scheme, is presented in Figure 9.

Based on the Integrated Wildlife Habitat Ranking System data, the majority of the EAA habitat has been ranked with a habitat value between 1 and 4. These rankings indicate that the EAA contains, in general, lower quality habitat than surrounding areas. The highest habitat value designated in the EAA was a value of 7 for an area in the southeastern EAA, adjacent to WCA-2A and just east of Parcel B. Holey Land and Rotenberger WMAs received a habitat value of 6. Habitat values in Parcels A, B, and C are ranked between 2 and 4.

3.5.5.3.4 FFWCC Biodiversity Hotspots

The FFWCC biodiversity hotspots maps (Endries *et al.*, 2001) represent areas of overlap among potential habitats of 54 focal species of wildlife and four important natural communities (pine rockland, sandhill, scrub, and tropical hardwood hammock communities). The focal species were selected based on their utility as indicators of natural communities or because they require suitable habitat conditions covering large areas. A complete listing of the focal species and other resources utilized to generate the biodiversity maps is available in Cox *et al.* (1994). The biodiversity levels are displayed as a color-coded GIS map which identifies the following biodiversity levels:

- 3-4 Focal Species Overlap
- 5-6 Focal Species Overlap
- 7+ Focal Species Overlap

The FFWCC biodiversity hotspots data set (Endries *et al.*, 2001) was reviewed for the EAA. Figure 10 depicts the biodiversity hotspots in the EAA and surrounding areas. According to the map, the highest levels of biodiversity in the EAA (seven or more focal species) are located in the southeast portion, adjacent to WCA-2A, east of Parcel B. This area also contains biodiversity levels of five to six focal species. The southern portions of the Holey Land and Rotenberger WMAs contain biodiversity levels between three and six focal species. The north-central portion of the EAA, southeast of Lake Okeechobee contains a biodiversity level of three and five focal species. In addition, the EAA contains very scattered, small, isolated areas with various biodiversity levels.

3.5.6 Threatened and Endangered Species

This section provides information regarding federally and state listed threatened and endangered species within the EAA and Parcels A, B, and C. Section 3.5.6.1 provides information regarding those protected species that may potentially occur in the EAA. Section 3.5.6.2 provides the results of a review of GIS data pertaining to protected species occurrence records and areas containing elevated numbers of listed species within

the EAA and Parcels A, B and C. This information can be used to assist in the alternative evaluation process as these data indicate areas that, if selected, may have a greater impact on protected species. Table 9 includes federally and state listed fish and wildlife species observed during the wetland verification and habitat function field-surveys of Parcels A, B, and C (see Section 3.5.4).

3.5.6.1 Potentially Occurring Listed Species within the EAA

A list of protected species including federally and state listed endangered species, threatened species, and species of special concern occurring or potentially occurring within the EAA and surrounding areas, was compiled using the following sources: literature reviews; documented sightings in the EAA; representatives from federal and state agencies (FWS, SFWMD, and FFWCC); FWS Threatened and Endangered Species System (TESS) (FWS, 2002); FFWCC Wildlife Observation Database, continuously updated (FFWCC, 2003b); FFWCC list of species protected by the State of Florida (FFWCC, 1997); FNAI Species and Natural Community Summary for Palm Beach, Martin, Hendry, and Glades Counties (FNAI, 1997); FNAI Rare Species and Natural Community Occurrences database, last updated June 2002 (FNAI, date unknown); and Rules of the Florida Department of Agriculture and Consumer Services (FDACS) Regulated Plant Index (FDACS, 2001) (SFWMD 2003a).

Based on the analysis above, 25 species of wildlife and one plant species are officially listed by federal and state agencies as potentially occurring in the EAA. Table 18 identifies these listed species, along with associated community types represented by the FFWCC land cover classes that have been identified within and/or adjacent to the project area. Refer to Section 3.5.3 for a description of FFWCC land cover data, maps, and community types.

Eleven federally listed species may potentially occur in the EAA (SFWMD 2003a). These 11 species, as shown in Table 18, include two endangered mammals (Florida panther and West Indian manatee), four endangered birds (Everglades snail kite, Florida

grasshopper sparrow [*Ammodramus savannarum*], red-cockaded woodpecker, and wood stork), two threatened birds (bald eagle and crested caracara), two threatened reptiles (American alligator and eastern indigo snake), and one endangered plant species which was observed outside the EAA project boundary but within the 2000-foot buffer zone along the border of Lake Okeechobee (Okeechobee gourd [*Cucurbita okeechobeensis*]). In addition, the Florida black bear is listed as a federal candidate species. Recovery Plans prepared by the FWS exist for 10 of the 11 species: the Florida panther, West Indian manatee, bald eagle, crested caracara, Everglades snail kite, Florida grasshopper sparrow, red-cockaded woodpecker, wood stork, eastern indigo snake, and Okeechobee gourd. Although the Florida grasshopper sparrow may be known or suspected to occur in FFWCC land cover classes (ecological community types) that are present in the EAA, sightings as far south as the EAA are unusual (Gaea Crozier, SFWMD, personal communication 2003).

Nine of the 11 federally listed species have been designated with the same status by the State of Florida (Table 18). The exceptions include the red-cockaded woodpecker, which is listed as endangered by the federal government and listed as threatened by the state, and the American alligator which is listed as threatened by the federal government and state listed as a species of special concern. In addition, the Florida black bear is a state listed threatened species. An additional 14 species are state listed including one endangered bird (peregrine falcon [*Falco peregrinus*]), three threatened birds (southeastern American kestrel, Florida sandhill crane, and least tern [*Sterna antillarum*]), nine bird species of special concern (roseate spoonbill [*Ajaia ajaja*], limpkin, little blue heron, reddish egret [*Egretta rufescens*], snowy egret, tricolored heron, white ibis, black skimmer, and Florida burrowing owl), and one reptile species of special concern (gopher tortoise).

3.5.6.2 GIS Data Pertaining to Threatened and Endangered Species

3.5.6.2.1 Species Occurrence Databases

As discussed in Section 3.5.5.3.1, the FFWCC 1987-1993 Wildlife Observation Database (FFWCC, 2003b), updated continuously, and the FNAI Element Occurrences Database (date unknown), last updated June 2002, were reviewed to identify verified listed and non-listed species occurrences within the EAA and surrounding area (SFWMD 2003a).

Figure 11a presents a map depicting the verified listed species occurrences identified by the FFWCC Wildlife Observation Database. Figure 11b presents a map depicting the verified listed species occurrences identified by the FNAI Element Occurrences Database. Table 15 is a combination of the verified listed and non-listed species observations in the FFWCC and FNAI databases described above, as well as bird observations in the EAA compiled by Elise Pearlstine (University of Florida) and the FWS. The FFWCC and FNAI map designations (Map ID) for listed species in Figures 11a and 11b are identified in the table along with the federal and state listed status.

Based on the above data, there are observation records (sightings) for eight federally listed species, including five endangered species (Everglades snail kite, Florida grasshopper sparrow, Florida panther, Okeechobee gourd, and wood stork) and three threatened species (American alligator, bald eagle, and crested caracara). The Okeechobee gourd was observed outside of the EAA project boundary but within the 2000-foot buffer zone along the border of Lake Okeechobee.

There are observation records for 20 state listed species including six endangered species (Florida panther, Everglades snail kite, Florida grasshopper sparrow, wood stork, peregrine falcon, and Okeechobee gourd), six threatened species (southeastern American kestrel, bald eagle, crested caracara, Florida sandhill crane, least tern, and snowy egret), and eight species of special concern (black skimmer, limpkin, little blue heron, reddish egret, roseate spoonbill, tricolored heron, white ibis, and American alligator).

3.5.6.2.2 FFWCC Breeding Bird Atlas and FFWCC Wading Bird Rookeries

FFWCC Breeding Bird Atlas (BBA)

As discussed in Section 3.5.5.3.2, the FFWCC BBA includes data collected between 1986 and 1991 (Endries *et al.*, 2001). Information and maps regarding the bird species observed in the EAA and surrounding area and their relative locations are included in Attachment D. Each colored area on the map represents species presence observed within that block. Each block contains approximately 7,000 acres.

Based on the FFWCC BBA survey data, 96 bird species were recorded in the EAA. As presented in Table 16, two of the 96 species are federally listed endangered species (Everglades snail kite and red-cockaded woodpecker) and two are federally listed threatened species (crested caracara and bald eagle). However, red-cockaded woodpecker sightings within the EAA are expected to be unusual occurrences and primarily in conjunction with adjacent habitat.

Three of the federally endangered species mentioned above (Everglades snail kite, crested caracara, and bald eagle) are similarly listed by the state. The red-cockaded woodpecker is considered a state threatened species. Eight additional species are state listed including two threatened species (Florida sandhill crane and southeastern American kestrel) and seven species of special concern (black skimmer, limpkin, Florida burrowing owl, little blue heron, snowy egret, tricolored heron, and osprey). However, the osprey is a species of special concern only in Monroe County (southernmost county in Florida).

FFWCC Wading Bird Rookeries

As discussed in Section 3.5.5.3.2, the FFWCC Wading Bird Rookeries data (FFWCC, date unknown-b) provide the general location of known wading bird rookeries in Florida. This data was reviewed to identify rookeries located in the EAA and in Parcels A, B, and C (SFWMD 2003a). The database contains survey data (activity status and nesting species) and associated observation dates for a FFWCC rookery survey conducted January through July 1999. The database also provides the activity status for each

rookery in the FFWCC's 1980s survey (1986 through 1989) and 1970s survey (1976 through 1978).

Three wading bird rookeries are identified in the EAA although no wading bird rookeries are identified in Parcels A, B, and C (SFWMD 2003a). Table 17 contains the survey data for these rookeries. Figure 8 depicts the location of the wading bird rookeries identified by the database. None of the species observed in the FFWCC Wading Bird Rookery database are federally listed species. However, under appropriate conditions, nesting wading birds inhabiting rookeries located in natural areas adjacent to or near the EAA (such as WCA-1, WCA-2, and WCA-3A), may forage on EAA lands during nesting season. Foraging nesting species from these adjacent areas may include the federally endangered wood stork and state listed species. Two state listed species of special concern (little blue heron and tri-colored heron) were observed nesting in the rookery located west of the North New River Canal, between Lake Okeechobee and the Bolles Canal on April 15, 1999. Three state listed species of special concern (little blue heron, tri-colored heron, and white ibis) were observed nesting in the rookery located south of the Hillsboro Canal, just east of the canal's intersection with the North New River Canal on April 20, 1999.

3.5.6.2.3 FFWCC Panther Telemetry and Road Kills Data

The Florida panther is a federally and state listed endangered species. The FFWCC Panther Telemetry Locations database (FFWCC, date unknown-d) and FFWCC Panther Road Kills database (FFWCC, date unknown-e) provide information regarding the location, activity status, and habitat of Florida panthers.

Panther Telemetry Data

The Panther Telemetry Locations database describes verified locations of radio-collared Florida panthers collected between February 1981 and June 2001. These data were collected by three entities: the FFWCC, Everglades National Park, and Big Cypress

National Preserve. The radio signals, transmitted from a radio collar around the panther's neck, are picked up with a radio antenna affixed to an airplane.

According to the panther telemetry database, the signals of three Florida panthers have been documented within the EAA. No panther telemetry data has been recorded within Parcels A, B, and C. Table 19 presents a summary of the available panther data including the panther identification number, date and time that the location data was recorded, activity code, habitat, and agency that collected the data. A description of the habitat categories is available in Land (1994). Figure 12 presents a map of the Florida panther radio-telemetry data in the EAA.

Florida panther 26 was documented in the EAA with two radiotelemetry data points (March 16 and April 9 of 1990). Both of these data points indicate that this panther was located in the southwestern portion of the EAA (one data point is located next to the Miami Canal). Both data records indicate that Panther 26 was located in thicket swamp and was inactive.

Florida panther 43 was documented in the EAA with 40 radiotelemetry data points. These 40 data points occur between June and September of 1991. The locations of Panther 43 within the EAA are all located next to the Miami Canal and stretch from the southern EAA agricultural boundary to south of the northern boundary of the Holey Land WMA. This panther was active in only two of the 43 data points and was located in a variety of habitats. The most frequent habitat was thicket swamp; however, Panther 43 also occurred in mixed herb and shrub marsh, sawgrass marsh, hammock forest, mixed swamp, and agriculture/disturbed habitats.

Florida panther 90 was documented in the EAA with 14 radiotelemetry data points. These 14 data points occur between March and April of 2001. The locations of Panther 90 within the EAA are the most widely distributed of the three panthers. Panther 90 records are located in the southeastern corner of the EAA, along the southern boundary of the EAA, and next to the Miami Canal (stretching from the southern EAA boundary to south

of the Bolles Canal). The activity status of this panther is not available. Panther 90 was most frequently located in the thicket swamp habitat, but also occurred in mixed herb and shrub marsh, sawgrass marsh, and agriculture/disturbed habitats.

Panther Road Kill Data

The location of Florida panther road kills is an indicator of where Florida panthers are located (Land, 1994). The FFWCC Panther Road Kills database (FFWCC, date unknown-e), containing data collected between 1972 and 2000, was analyzed to help determine whether panthers could potentially occur in the EAA and Parcels A, B, and C.

Based on these data, no Florida panther roadkills have been documented directly in the EAA. The closest panther road kill locations were recorded approximately two miles west of the EAA boundary. Figure 13 presents a map of the recorded Florida panther road kill locations in the vicinity of the EAA.

3.5.6.2.4 FFWCC Eagle Nest Locator Database

The bald eagle is a federally and state listed threatened species. The FFWCC Eagle Nest Locator database (FFWCC, 2003c) presents known and verified bald eagle nest locations in Florida that were surveyed from 1998-2002. In addition to nest locations, the database presents the yearly nest activity status for the 1998 through 2002 nesting seasons.

The most recent survey by the FFWCC occurred during the 2002 nesting season using fixed-wing or rotary-wing aircraft beginning in late November 2001 and extending through mid-April 2002. Nests discovered more recently than April 2002 are not yet included in the database. Therefore, the absence of an eagle nest record for a given location does not necessarily mean nesting eagles are not present (FFWCC, 2003c).

Based on the FFWCC Eagle Nest Locator database, five bald eagle nests have been documented in the EAA. Figure 14 presents a map depicting these nest locations. Table 20 presents the bald eagle nest identification numbers, along with each nest's yearly nest

activity status for the 1998 through 2002 nesting seasons, and the last documented year of activity.

All five nests are located in Palm Beach County. The first nest, designated as PB003 and located along the southeastern shore of Lake Okeechobee, was last reported as active in 1995. From 1998 through 2000, this nest was either unobserved or has an unknown activity status. Nest PB010, located along the L-13 Canal (Ocean Canal), less than two miles west of the northwest corner of STA-1W, was reported as active during the 1998-2002 nesting seasons. Nests PB014 and PB015, located along the southeastern shore of Lake Okeechobee, were reported as unobserved or unknown activity in the 1998-2001 nesting seasons and as active in 2002. Nest PB001, located along the southern shore of Lake Okeechobee, was reported as active during the 1998-2002 nesting seasons.

3.5.6.2.5 FFWCC Wildlife Potential Habitat Models

The FFWCC Potential Habitat Models (FFWCC, date unknown-c) were used to identify and calculate potential habitat areas for those wildlife species that might occur in the project area (SFWMD 2003a). It should be noted that “potential habitat” refers to habitat conditions supportive of particular fish and wildlife species but does not indicate actual species observations or presence in the areas indicated.

In developing the FFWCC Potential Habitat Model, Cox and Kautz (2000) attempted to create potential habitat maps for 124 rare vertebrate species including all state listed vertebrates in Florida (except fish, sea turtles, and marine mammals) and those species deemed to be imperiled by the Florida Committee on Rare and Endangered Plants and Animals (FCREPA). Due to the type of wildlife included in this model (listed and/or rare), the results are discussed in this section of the report. Maps of potential habitat could be generated for only 76 state listed species due to inadequate information for the remaining 48 species. The potential habitat models are based on a combination of data, including species occurrence records, digital maps of Managed Areas, species range maps, maps of vegetative cover, life-history requirements, and a large number of digital

data sets including maps of soils, roads, and stream reaches (Cox and Kautz 2000). It should be noted that many of the 76 potential habitat model maps that were created may have low accuracy (Cox and Kautz 2000). Although the accuracy of the potential habitat models may be low for determining habitat presence, they may be useful for guidance during the alternative formulation process for the EAA Project (SFWMD 2003a).

The model uses ArcInfo grid files to calculate total acres of potential habitat for each potentially occurring species by multiplying the total number of occurrence grid cells by the area of each grid cell. Each grid cell is 100 meters by 100 meters (10,000 m²), or approximately 2.47 acres. Thus, acres of potential habitat are based on whole grid cells and are estimates of habitat area.

Of the 76 species with potential habitat models, 33 habitat models reveal potential habitat within the EAA (SFWMD 2003a). Table 21 presents the acreage of potential habitat and Attachment E includes maps of potential habitat for each of the 33 species. Of the 33 species identified, seven are federally listed as endangered or threatened and one species is listed as a federal candidate species. The federally listed endangered species include the Everglades snail kite, red-cockaded woodpecker, and wood stork. Although the model may indicate potential habitat for the red-cockaded woodpecker, it is doubtful that this species is a resident of the EAA (Gaea Crozier, SFWMD, personal communication 2003). The federally listed threatened species include the bald eagle, crested caracara, American alligator, and eastern indigo snake. The Florida black bear is listed as a federal candidate species.

Five of the seven federally listed species have been designated with the same status by the State of Florida. The exceptions are the American alligator, which is a state listed species of special concern, and the red-cockaded woodpecker and Florida black bear which are state listed threatened species. An additional 11 species are state listed including one threatened species (Florida sandhill crane) and 10 species of special concern (Sherman's short-tailed shrew [*Blarina carolinensis shermani*], Sherman's fox

squirrel, limpkin, little blue heron, snowy egret, tricolored heron, white ibis, osprey in Monroe County, Florida burrowing owl, and gopher tortoise).

The habitat models reveal potential habitat for 14 of the 33 species within Parcels A, B, and C: the river otter, round-tailed muskrat, Shermans's short-tailed shrew, black-crowned night heron, black rail, least bittern, little blue heron, mottled duck, Swainson's hawk (*Buteo swainsoni*), wood stork, yellow-crowned night heron, American alligator, eastern diamondback rattlesnake (*Crotalus adamanteus*), and eastern indigo snake. Of these, one species is federally listed as endangered (wood stork) and two species are federally listed as threatened (American alligator and eastern indigo snake). In addition, Swainson's hawks are primarily a western North American species and sightings are unusual in south Florida except, perhaps, during winter migration when they may stopover in Florida while traveling south (Wheeler and Clark 1995).

Five of the 14 species are state listed including one endangered species (wood stork) and four species of special concern (Sherman's short-tailed shrew, little blue heron, American alligator, and eastern indigo snake).

3.5.6.2.6 FFWCC Listed Wildlife Species Distribution Locations

The FFWCC Listed Wildlife Species Distribution Locations data (Endries *et al.*, 2001) represent a combination of the wildlife potential habitat models for those species that are federally or state listed as endangered, threatened, or species of special concern. The results are classed based on the potential habitat and listing status of species and given a value. The ranking system of the coverage is based on both the status and number of listed species with potential habitat occurring.

A map describing potential habitat locations in the EAA based on the above data is presented in Figure 15. The values of each relate to a graduated color scheme indicated on the map. The two areas that scored the highest value (10) and thus represent areas with potential habitat for at least one endangered species, were the southeast portion of the EAA adjacent to WCA-2A and just east of Parcel B and the areas immediately adjacent

to WCA-2A. Areas that received relatively high scores of six or seven (potential habitat for 1-3 threatened species) were located immediately south of Lake Okeechobee, southeast of Lake Okeechobee adjacent to WCA-1A and WCA-2A, and scattered throughout the northeastern portion of the EAA. The Holey Land and Rotenberger WMAs received scores of one indicating potential habitat for one species of special concern.

3.5.7 Literature Cited

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